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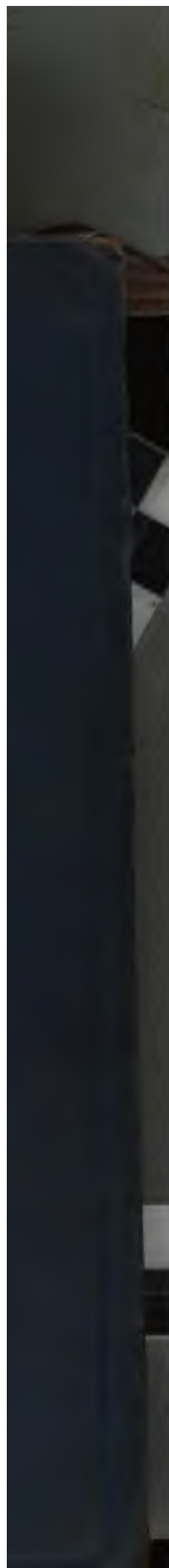
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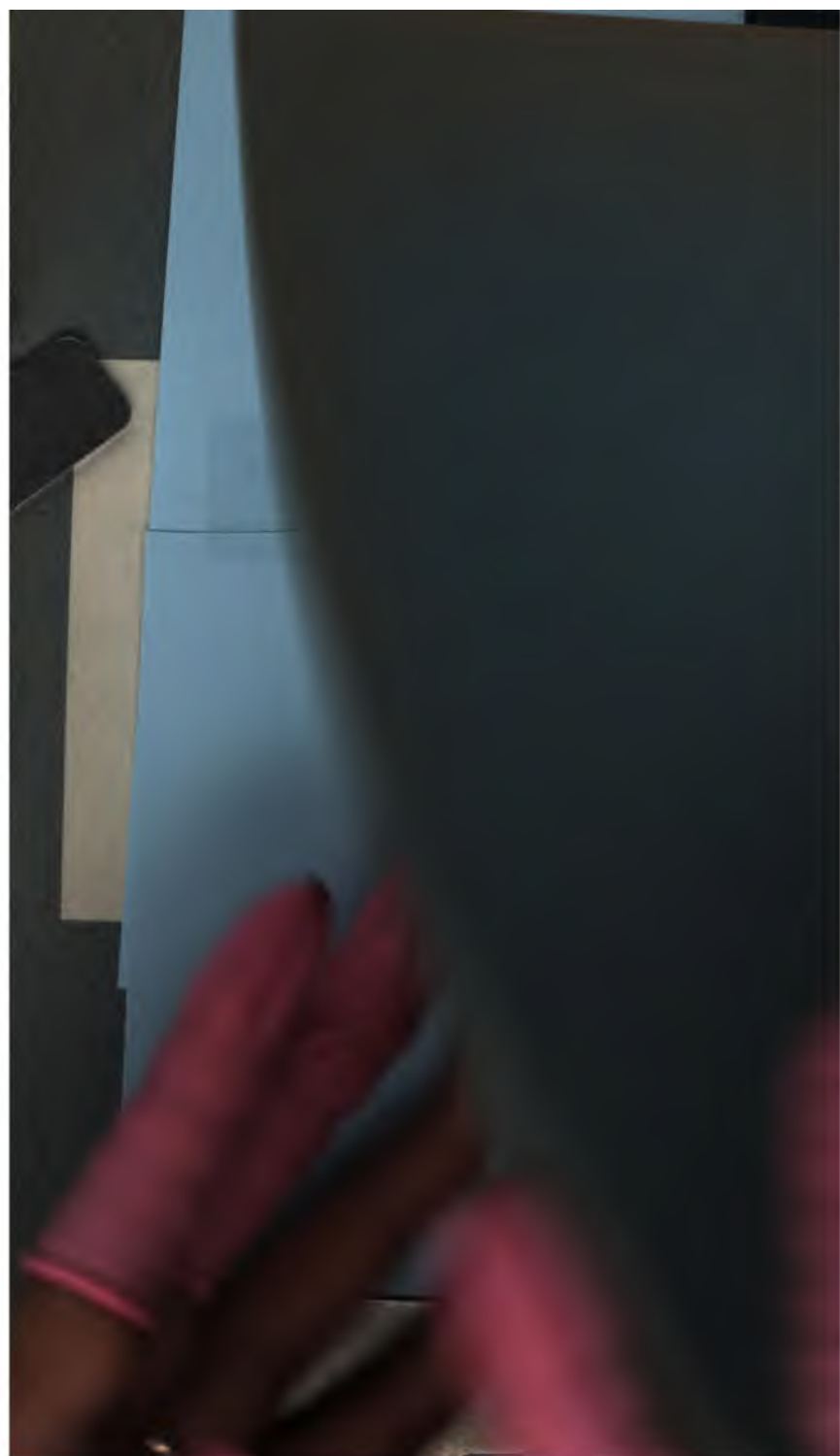
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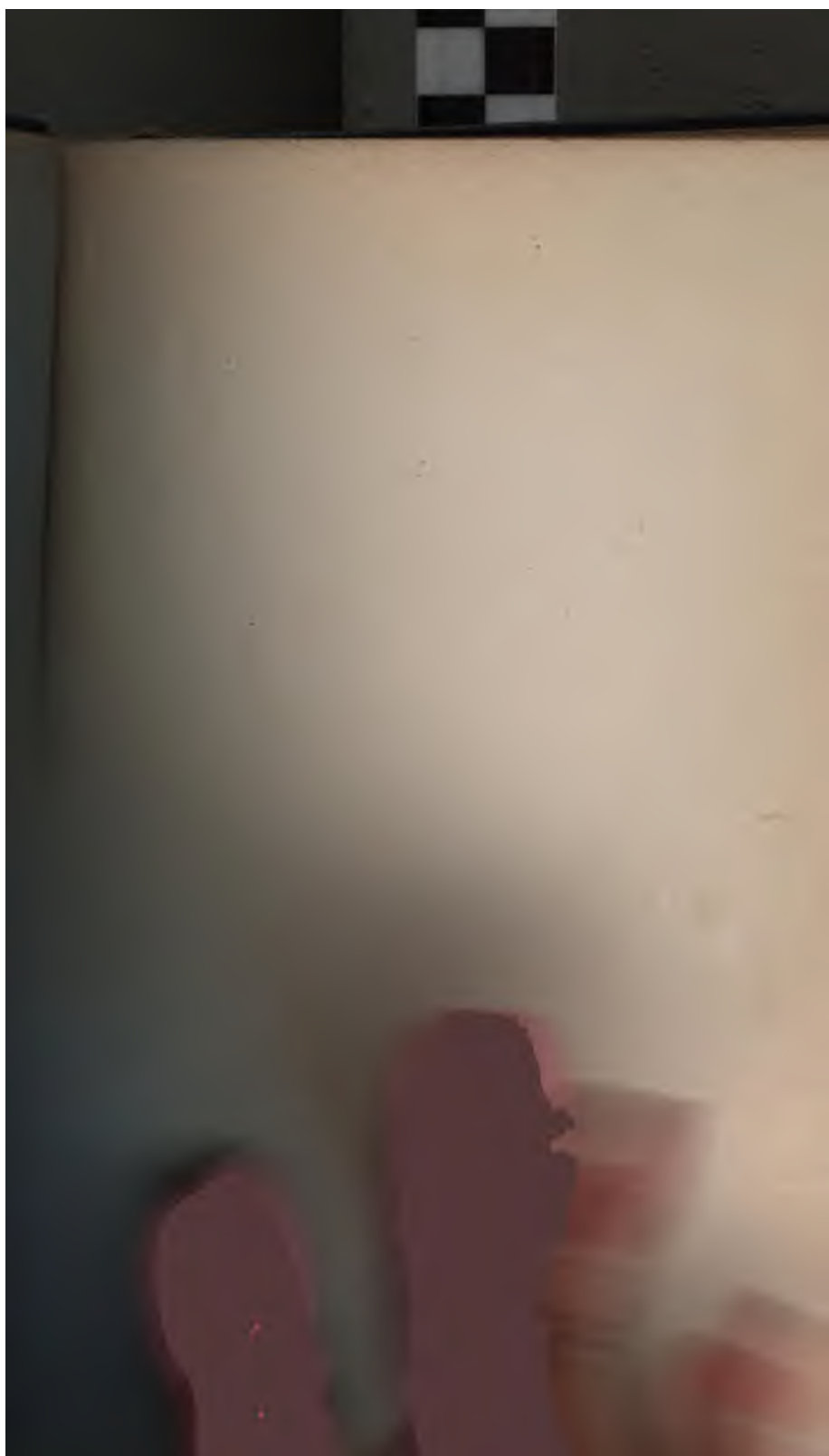
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OUTLINES
OF
INTERNAL MEDICINE
FOR THE USE OF NURSES

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SECOND AND REVISED EDITION

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TO

DR. JOSEPH SAILER

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PREFACE TO THE SECOND EDITION.

IN many training schools for nurses systematic courses in medicine are now being offered in place of the desultory, haphazard lectures formerly in vogue. This textbook is intended to supply the basis for such a course and in addition to serve as a work of reference to which the nurse may turn for information concerning the rarer cases which may come under her observation. Symptomatology, prophylaxis, and treatment other than by drugs, have received particular emphasis (see Introduction). Nevertheless the writer has not thought it necessary to discuss, except incidentally, topics such as bed-making, cupping, or hot packing, which are adequately treated in works on general nursing.

The book is divided into ten "Parts," eight of which are devoted to diseases of the various systems and two to harmful agencies (physical, chemical, bacterial) invading the body from without. Each "Part" is introduced with a discussion of the symptoms, signs, etc., most often observed in diseases of the particular system under consideration. When infectious diseases (Part X) are taken up, therefore, the student has already become familiar with the widely diversified clinical manifestations which may be observed in this important class of diseases. Not only has the usual position of the infectious

diseases been changed but their sequence has also been altered to conform with the requirements of prophylaxis, as far as data for such an arrangement are available. Technical terms have not been avoided but have usually been defined where they first occur.

In the preparation of this book the author has drawn as much as possible on his own experience and his current medical knowledge. He has not thought it essential, except in occasional instances, to refer to original sources. Text-books have been freely consulted, notably those of Osler and McCrae (Medicine), Mackenzie (Heart), Ker (Infections), Sahli (Diagnosis), Bury (Nervous Diseases), and Rosenau (Hygiene).

No radical changes have been made in the second edition, but advantage has been taken of the opportunity to correct obvious misprints, to prune unessential passages and to add such additional matter as medical progress demands.

The writer is indebted to Miss C. Blanche Soule, Dr. Maurice Ostheimer and Dr. Charles W. Lüders for aid in the revision.

C. B. F.

PHILADELPHIA, 1917.

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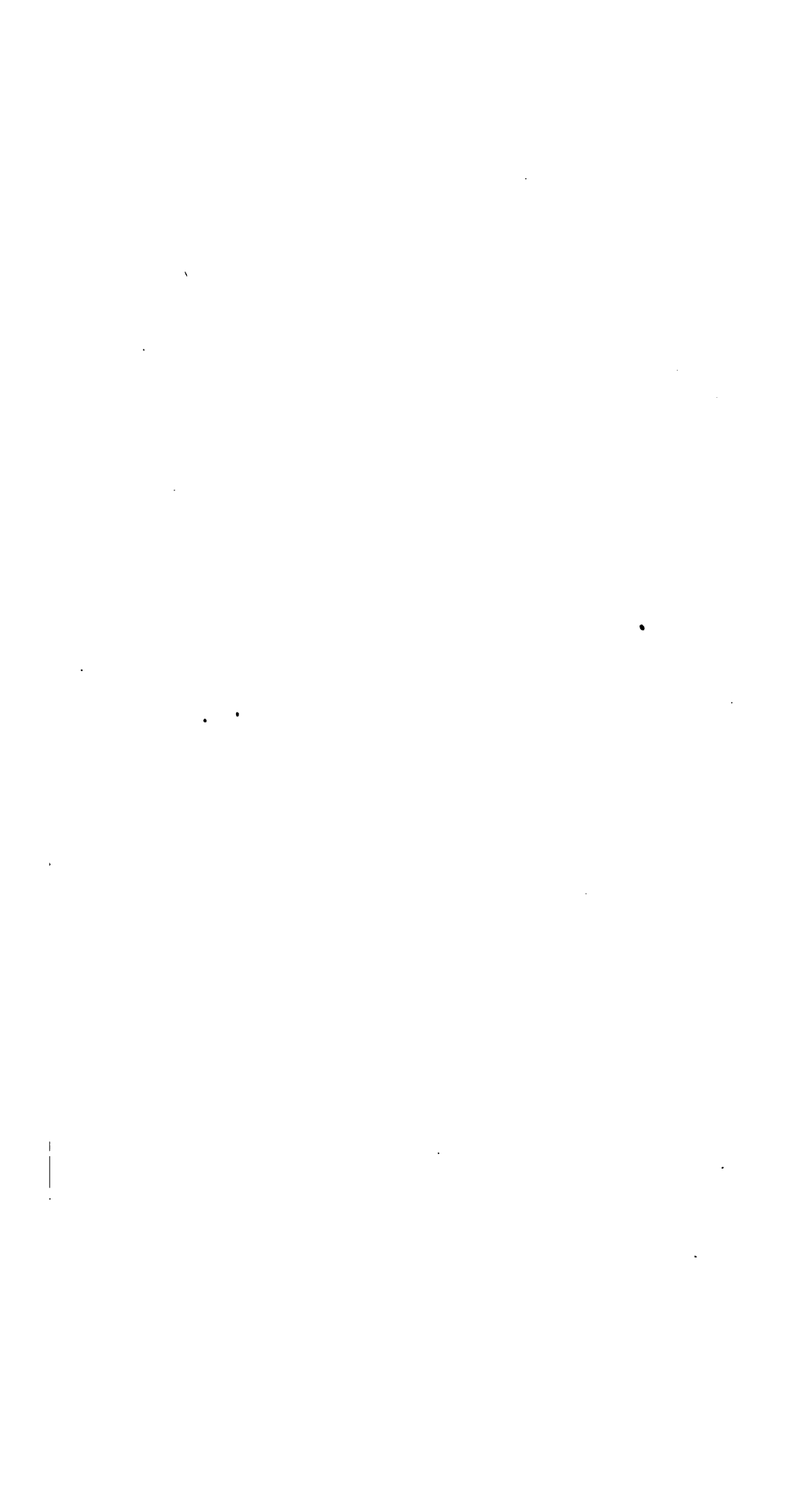
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OUTLINES OF INTERNAL MEDICINE FOR THE USE OF NURSES.

INTRODUCTION.

THE NATURE OF DISEASE.
THE WIDE SCOPE OF INTERNAL
MEDICINE
Principal Subdivisions.
COMMON DISEASES IN ADULTS.
COMMON NERVOUS DISEASES.

DISEASES OF CHILDHOOD AND OLD
AGE.
RELATIVE FREQUENCY OF THE IN-
FECTIONS.
TROPICAL DISEASES.
CHIEF CAUSES OF DEATH.

THE NATURE OF DISEASE.

DISEASE in its broadest significance is defined as "any departure from the normal standard of structure or function of a tissue or organ" (*Encycl. Brit.*). Such deviations, when regularly associated in a more or less uniform "complex," with definite cause, course, and termination, constitute a disease in the more restricted sense. Symptoms are the surface indications of these deviations of structure or function. As such they betoken an attempt of the individual to adapt himself to abnormal conditions within or to resist harmful influences from without. In most instances they are not to be regarded as the weapons of an invading enemy to be opposed at every point, but as signs of a salutary activity on the part of the body which should be assisted, or at the most restrained and regulated. Even fever, if not excessive, is now believed to serve a useful purpose in infectious diseases. It is rarely possible to attack directly the harmful agency, whether physical, chemical, or bacterial. In

malaria we are able to destroy the causative organism by means of quinin; in diphtheria we anticipate the bodily defences and furnish an antidote (antitoxin) to the bacterial poisons (toxins). In most diseases, however, there is no question of a specific, and the duty of the physician and the nurse is to treat and care for the individual with the object of increasing his natural defences, or of adapting his mode of life to suit his impaired organs or functions.

THE WIDE SCOPE OF INTERNAL MEDICINE.

The vast field of the general subject of medicine has led to its separation into more or less arbitrary divisions, of which the chief are obstetrics, surgery, and medicine. The term Internal Medicine, although not very happy, is gradually coming into use to designate the latter division more precisely. (A physician who devotes himself exclusively to this department of medicine is therefore often called an "Internist.") On the "borderland," as the Germans say, between internal medicine and surgery (external medicine) there is an ever-increasing array of diseases. Many of these, which until recently were considered purely medical, are now of equal interest to the physician and the surgeon. As examples may be cited appendicitis, gastric and duodenal ulcer, gall-bladder disease, and even constipation ("intestinal stasis"). In addition to these major divisions there are important subdivisions devoted to the eye, the ear, the nose and throat, the teeth, and the skin. Gynecology, genito-urinary surgery, orthopedic surgery, pediatrics, neurology, etc., are less clearly defined specialties which ordinarily fall within the scope of the general physician or surgeon. In this little volume internal medicine and its boundary zones alone will be considered.

Principal Subdivisions.—The study of clinical medicine includes a consideration of special pathology, diagnosis, prognosis, and treatment. Special pathology comprises

etiology (causation), morbid anatomy (disordered structure), and morbid physiology (abnormal function). While morbid anatomy is of fundamental importance to the physician, it does not require as thorough consideration here, and the same is true of physical or objective diagnosis, prognosis, and medicinal treatment. Symptomatology (including course, complications, and sequelæ), prophylaxis (based on etiology), diet, and physical modes of treatment (including nursing) are, on the other hand, subjects with which the nurse can hardly be too familiar. In a general survey of clinical medicine it will be necessary to mention, or to discuss briefly, many diseases which are comparatively rare and, from the nurse's stand-point, unimportant. These topics are, nevertheless, of value in giving the nurse a broader view and in stimulating her interest in her profession. In order to counteract any undue attention given to these subjects, and to place the various diseases in their proper perspective, a preliminary review of the affections chiefly responsible for morbidity (sick-rate) and mortality (death-rate) will now be given. This will include a list of the diseases most prevalent in infancy and in old age and of the affections peculiar to the tropics.

COMMON DISEASES IN ADULTS.

On the basis of dispensary statistics the following appear to be the most common diseases or disease groups in adults (nervous diseases and the eruptive fevers are not included): chronic dyspepsias (including functional or nervous dyspepsia, gastroptosis, chronic gastritis, and constipation), pulmonary tuberculosis, cardiovascular disease (endocarditis, myocardial insufficiency, and arteriosclerosis), bronchitis and asthma, rhinitis, tonsillitis and pharyngitis, rheumatism and arthritis, nephritis, pleurisy, muscular rheumatism, anemias (largely secondary), acute gastritis and gastro-enteritis, appendicitis. Cancer, particularly of the gastro-intestinal tract, and gall-bladder

disease, although they do not loom large in dispensary statistics, are prolific causes of morbidity and mortality in persons between the ages of forty and sixty.

COMMON NERVOUS DISEASES.

Of nervous diseases the following appear to be the more prominent: neurasthenia, neuritis, epilepsy, chorea, acute poliomyelitis and its results, hysteria, insanity, mental deficiency, hemiplegia, tabes, cerebrospinal syphilis.

DISEASES OF CHILDHOOD AND OLD AGE.

In children the following diseases are responsible for the highest morbidity: bronchitis, chronic intestinal indigestion, diarrheal diseases, tonsillitis, rickets, adenoids, enlarged tonsils, enlarged glands, enuresis, acute and chronic gastritis.

The aged (over sixty) naturally suffer from degenerative changes of all the organs and tissues. We can only cite as examples: arteriosclerosis, myocarditis and sclerotic diseases of the valves of the heart, emphysema, chronic interstitial nephritis, atony of the stomach and constipation, hemorrhage and softening of the brain, senile dementia. Other diseases particularly prevalent in the aged are chronic bronchitis, asthma, bronchopneumonia, chronic arthritis (rheumatism), paralysis agitans, cancer and erysipelas. Many diseases in the aged are very atypical in their symptoms and course; in typhoid, for instance, the fever may be slight and irregular, in pneumonia it may be altogether absent.

RELATIVE FREQUENCY OF THE INFECTIONS.

The relative frequency of the infections can be stated with greater accuracy on the basis of the reports to the Bureau of Health (Philadelphia). They may be arranged

as follows: tuberculosis, measles, diphtheria, chicken-pox, mumps, scarlet fever, lobar pneumonia, typhoid fever, and whooping-cough. Tuberculosis and diphtheria show comparatively slight variations from year to year. In Philadelphia, prior to filtration, typhoid fever was four to six times as prevalent as at present. Measles, mumps, and whooping-cough show tremendous variations in frequency, depending on the presence or absence of epidemics.

TROPICAL DISEASES.

The continuous high temperature of the tropics directly induces sunstroke, heat exhaustion, and general debility, but its indirect effect in favoring the growth of all sorts of vegetable and animal parasites, is far more important. Animal parasites are particularly frequent and give rise to a long array of skin diseases in addition to strictly medical affections. Intestinal and visceral parasites are much more common and serious than in the temperate regions. Some of the more characteristic diseases of the tropics, not all of them confined to that zone, are the following: malaria, filariasis, relapsing fever, sleeping sickness, amebic dysentery, leprosy, plague, cholera, Malta fever, yellow fever, dengue, and beriberi. Most of the diseases prevalent in cold climates also occur, although some infections, such as acute articular rheumatism, are naturally rare.

CHIEF CAUSES OF DEATH.

The chief causes of death are sufficiently illustrated by the statistics of Philadelphia for 1913, which are summarized as follows: lung diseases, including tuberculosis and pneumonia, caused 20.4 per cent. of the deaths; heart diseases, 11.6 per cent.; kidney diseases, 9.9 per cent.; cancer, 6 per cent.; all epidemic diseases, 5.1 per cent.; violence, 6.2 per cent.; 21.9 per cent. of the deaths were in children under two years. Among the latter,

birth accidents and diarrheal diseases were the most important causes. Enteritis and diarrheal diseases of

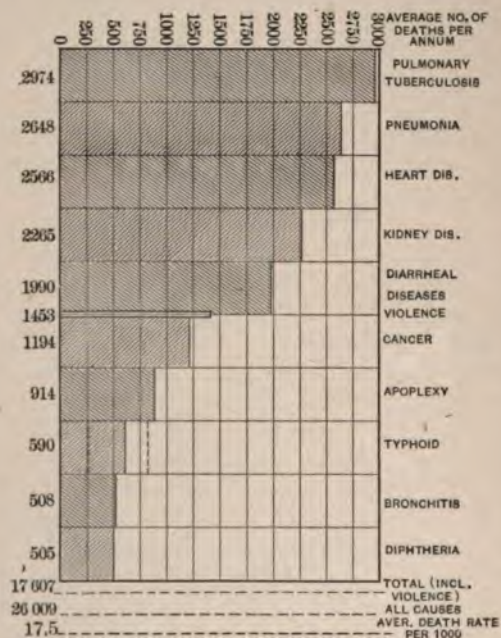


FIG. 1.—The chart shows the average number of deaths per annum (1903-12) in Philadelphia (population 1,500,000) from ten of the most important diseases or disease groups. Also the deaths from violence. During the first six years the deaths from typhoid averaged 812, during the last four years (filtration) 256.

infants, though present at all seasons, are tenfold more fatal in midsummer.

PART I.

NERVOUS AND MENTAL DISEASES.

CHAPTER I.

GENERAL CONSIDERATIONS.

THE NEURONS.
MOTOR AND SENSORY TRACTS.
SYMPTOMS AND SIGNS OF NERVOUS
DISEASE.
Insomnia.
Delirium and Confusion.
Stupor and Coma.
Aphasia.
Headache.
Vertigo.
Hyperesthesia, Anesthesia, and
Pain.

Sphincter Disturbances.
Trophic Disturbances.
Vasomotor Disturbances.
Paralysis.
Convulsions.
Contractures and Spasticity.
Tremors and Choreiform Move-
ments.
Ataxia.
Reflexes.
Special Senses.
LUMBAR PUNCTURE.

NERVOUS and mental symptoms play such a large part in many general diseases that an early consideration of affections of the nervous system seems logical and time-saving. A brief survey of the commonest symptoms which may be attributed to disturbances of this system will be followed by sketches of the more important diseases. Psychological, physiological, and anatomical considerations, essential as they are to a full understanding of nervous diseases, will receive scant attention. It will only be necessary to supplement the ordinary stock knowledge of anatomy and physiology which the nurse is assumed to possess, by a brief account of the "neuron," the ultimate nervous unit, and its function.

THE NEURONS.

The brain and cord consist essentially of gray matter (cells) and white matter (fibers), with investing and supporting structures (membranes and neuroglia). Each fiber begins in a cell, and the two together constitute a neuron, the fiber being dependent for its nutrition on the healthy condition of the cell ("trophic influence"). A motor neuron is shown diagrammatically in Fig. 2, *C-D*. The cell *C* has fine, so-called protoplasmic processes, which interlace with similar fibrils from other cells, and a

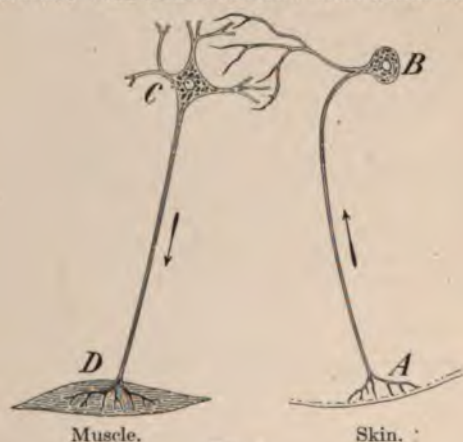


FIG. 2

main or axis-cylinder process which ends in a muscle (*D*). A sensory fiber (*A-B*), on the other hand, begins in the skin, *e. g.*, and runs toward the cell *B*, from which fibrils pass out and interlace with the processes of the motor cells *C*. Such a combination of neurons forms a reflex arc. If the skin is irritated at *A* an impulse is conveyed through *B* to *C*, whence a motor impulse is sent out to *D*, causing the muscle to contract. For example, if we stroke the inner side of the foot a flexion of the big toe occurs. As a matter of fact a reflex is much more complicated, involving many neurons, but the principle

is the same. If a motor cell (*C*) in the spinal cord is destroyed its axis-cylinder process and the muscles which the latter supplies will degenerate, as in infantile palsy.

MOTOR AND SENSORY TRACTS.

A motor "tract" consists of at least two superimposed neurons or segments (Fig. 3). The "upper segment" begins in a cell (*C'*) in the cortex of the brain, passes downward through a narrow bundle called the internal capsule, and crosses to the opposite side of the body, either at the lower part of the brain or in the spinal cord. After crossing it ends in twig-like processes *D'*, which surround the cell body (*C*) of a second neuron ("lower segment"). The latter continues to its termination in a muscle, as already described. If any injury occurs to the upper segment above the point where it crosses, paralysis follows on the opposite side of the body, as in hemiplegia (see Fig. 9); if below, on the same side of the body. Since the lower segment is not directly involved, its nerve fiber and muscle will not degenerate or waste, and after the first shock has passed, reflex action will be found preserved. Usually, indeed, it is increased because



FIG. 3

the moderating (brake-like) action of the upper segment is removed, permitting a spasmodic or spastic condition to develop. This is seen typically in spastic paraplegia, due to disease of the spinal cord, and in long-standing hemiplegia. Disease or injury involving the lower motor segment causes paralysis and wasting of the muscles, and loss of the reflexes. It is observed, for example, in acute poliomyelitis and neuritis. The sensory tracts are similar in principle, but there are three or more neurons between the sensitive surface and the centre in the brain. Motor neurons are called "efferent" because the impulses travel from the centre outward (*ex*), while sensory fibers are described as "afferent" because they convey impulses toward (*ad*) the brain.

SYMPTOMS AND SIGNS OF NERVOUS DISEASE.

Insomnia.—Sleep disorders are extremely common: thus we have wakefulness (insomnia), disturbed sleep, and abnormal sleepiness. The latter is a symptom of both acute and chronic infections, as in measles and "sleeping sickness." It also occurs in exhaustion, neurasthenia, etc. Disturbed sleep is characterized by restlessness, dreams, nightmares, night terrors, somnambulism, etc. Insomnia frequently occurs as an isolated symptom. It is also a pronounced feature of delirium or insanity. Patients who are addicted to morphin and other sedatives are often tortured by intractable insomnia upon withdrawal of the drugs. Simple insomnia, when it is not due to pain, is perhaps most frequently to be attributed to circulatory disturbances (*e. g.*, cerebral congestion), to worry, to bad habits of sleep, or to beverages containing caffein (tea, coffee, or allied substances). Sleep may sometimes be induced by gentle exercises which will tend to draw the blood from the brain; by hot applications to the feet; by warm drinks, such as hot milk; by diversions or light reading; by the formation of regular habits, and by omission of tea, coffee, and chocolate.

Delirium and Confusion.—Pathological disturbances of consciousness are described by the terms confusion, delirium, stupor, and coma. Delirium is of varying degrees, from a mild form in which there is merely slight confusion, to the wild, maniacal variety. Insanity is marked by symptoms which often differ very little from those of delirium, and are distinguished largely by their more or less permanent character and their independence of acute bodily diseases. Ordinary active delirium is characterized by muscular restlessness, by insomnia, by failure to recognize surroundings or friends, and by illusions, hallucinations, and delusions. Illusions may be defined as faulty perceptions, that is, the patient mistakes common objects and noises for "shapes and shrieks and sights unholy." Hallucinations, so common in delirium tremens, are pure figments of the imagination without any material foundation. Thus, dying alcoholics often fancy that they are driving horses.¹ Delusions are false beliefs; the patient, for example, imagines that someone is trying to injure him, etc. The "muttering" delirium of typhoid and other "low" states often verges on stupor. Shakespeare describes it vividly in *Henry the Fifth* (Falstaff's death): "After I saw him fumble with the sheet and play with flowers and smile upon his fingers' ends, I knew there was but one way; for his nose was sharp as a pen; an a' babbled of green fields."

Stupor and Coma.—In stupor the patient is apparently unconscious, but may be aroused by shouting or shaking. In coma, unconsciousness is complete. Stupor and coma are common manifestations of both febrile and non-febrile conditions, and particularly of diseases or injuries of the brain, of poisons, such as alcohol and opium, and of toxemias, such as uremia and the acid intoxication of diabetes. The coma of uremia is frequently accompanied by convulsions and Cheyne-Stokes respiration, and that of diabetes by extremely rapid breathing ("air hunger").

¹ The orderlies at the Philadelphia Hospital, from long experience, attach grave prognostic significance to this particular hallucination.

In hysteria, patients at times lie in an apparently unconscious condition, but their appearance is that of simple sleep. In cataleptic states the patient may assume fixed or rigid positions, or he may walk about without apparently being conscious of what he is doing.

Aphasia.—Aphasia (speechlessness) is a “partial or complete loss of the power of expressing ideas by means of speech or writing.” It is associated with other paralytic phenomena in cerebral hemorrhage, softening, and tumor, and is of value in locating the situation of the brain lesion, because its various forms are dependent on injury to quite different portions of the cerebral cortex. In sensory aphasia spoken or written words are not understood or remembered. In motor aphasia words may be comprehended, but on account of cerebral diseases, the power of speech or writing is lost. Defective articulation due to peripheral palsy is not aphasia. Not long since I saw a man with cerebral embolism and hemorrhage who was unable to articulate on account of laryngeal paralysis produced by the pressure of an aneurysm. This was not aphasia, although at first so diagnosed on account of the associated paralysis. Ordinary loss of voice (aphonia) is due to mere local changes in the larynx, such as congestion or tumor of the vocal cords. Hysterical aphonia, however, is undoubtedly of central origin. Other speech disturbances which may be enumerated are stuttering, stammering, and scanning speech. Patients with the latter disorder talk in a stilted manner as if they were reading poetry.

Headache.—Headache is a symptom of so many diverse diseases that only a few of the important causes can be noted: (1) Some so-called headaches are rheumatic or neuralgic affections of the scalp. (2) Headache may be due to disease in the bone or sinuses, as in syphilitic osteitis or frontal sinus disease. (3) Headache may be due to meningitis, brain tumor (including syphilis), abscess, etc. (4) Headache may be due to disturbances of circulation, either congestion or anemia. (5) Headache may

be due to various toxic conditions (a typical example is that found in Bright's disease and in uremia). (6) Reflex headaches are ascribed mainly to the eye and to the digestive and genital organs. (7) Hysterical headache is often compared to a nail being driven into the head. (8) There is a specific form of headache known as "migraine;" in typical cases this is confined to one side of the head and recurs periodically; in women it may begin at puberty and end at the menopause.

Vertigo.—Vertigo is also attributable to a multitude of causes, of which the most important are: disturbances of the circulation as in arteriosclerosis, disturbances of the internal ear, cerebellar disease, reflex causes (ocular, gastro-intestinal), toxic causes as in alcoholism and uremia. Dizziness also occurs in hysteria and epilepsy.

Hyperesthesia, Anesthesia, and Pain.—Disturbances of sensation occur under many guises. Hyperesthesia is an undue sensitiveness to touch or to other stimuli. Anesthesia is a condition of insensibility to touch or to pain (analgesia). The latter is frequently observed in hysterical patients who experience no discomfort even from pin stabs. Paresthesia is a perversion of sensation. Patients complain of numbness or burning, or of a sensation as of ants crawling over the skin. Actual pain may vary in intensity from a sensation allied to discomfort to the agonizing variety seen in "tic douloureux." It is described as burning, throbbing, shooting or stabbing. Its fixed or radiating character is often significant.

The condition of sensation is determined by touch, by applying heat or cold (test-tubes filled with hot or cold water), or by pricking with the needle. In the disease known as syringomyelia the sense of touch is preserved, while the appreciation of heat and cold, and of pain may be lost. The sense of form and of position may also be tested by appropriate methods.

Sphincter Disturbances.—Disturbances of the bladder and rectum (sphincter disturbances) frequently occur in organic nervous disease on account of the loss either of

the normal sensation or of muscular control (paralysis). Retention of urine, constipation, or incontinence of urine and feces, are the natural consequences of these conditions.

Trophic Disturbances.—Trophic disturbances in the muscles, skin, and other tissues result from disease or injury of the nerve cells which control nutrition. The affected parts may waste (atrophy), or ulcers, bed-sores, and destructive joint disease, as in locomotor ataxia, may develop. One method of estimating the nutrition of the muscles is by testing their ability to contract with a battery (presence or absence of the "reactions of degeneration").

Vasomotor Disturbances.—Vasomotor disturbances are due to abnormal functioning of the sympathetic nerves which control the bloodvessels. Flushing or blanching of the face or other parts, and localized sweating or edema are examples of abnormal vasomotor control. The most extreme example of vasomotor disturbance is seen in Raynaud's disease, commonly known as "dead fingers," in which one or more fingers or toes become white and bloodless, later blue, and, finally in extreme cases, gangrenous. In angioneurotic edema intense but transient edema may appear. An arm may swell suddenly to a great size and as suddenly return to normal. Hives or urticaria is a similar but less marked expression of the same tendency probably induced by mild toxemia (intestinal) or infection.

Paralysis.—By paralysis is meant loss of power in the muscles. As types of paralysis we may refer to hemiplegia, in which there is paralysis of one side of the body; paraplegia, in which there is paralysis of both lower extremities; diplegia, affecting all the extremities, and monoplegia, in which one extremity only is affected. In some affections paralysis may be irregularly distributed. Familiar examples of paralysis are ptosis (paralysis of the upper eyelid), facial palsy, and wrist-drop. (See Multiple Neuritis—illustration.)

PLATE I



Opisthotonus in a Case of Cerebrospinal Meningitis. (Koplik.)



Convulsions.—In convulsions there is abnormal, involuntary activity of the muscles. In the "clonic" type the contractions occur intermittently and irregularly, as in infantile convulsions, uremia, puerperal eclampsia, and epilepsy. This type is simulated by hysterical convulsions, which, however, are not accompanied by complete unconsciousness. "Jacksonian" convulsions begin in, or are often limited to, one part. They point to a localized irritation of some motor area in the brain, caused for example by a tumor. "Tonic" convulsions are characterized by a more or less persistent contraction of the muscles, causing retraction of the head, arching of the back, rigidity of the abdomen, etc. Consciousness is usually preserved. These are seen typically in tetanus, meningitis, and in strychnin poisoning. Extreme retraction of the head with arching of the back is known as "opisthotonos." Tetany is a rare condition of tonic spasm observed in wasting diseases of childhood, in dilatation of the stomach, etc. The elbows are bent, the thumbs turned into the palms of the hands, and the feet extended (straightened out).

Contractures and Spasticity.—Contractures bear a superficial resemblance to tonic spasms but are more permanent. In this condition there may be a shortening of the muscles due to irritation, as in the familiar Kernig's sign of meningitis (the leg cannot be extended when the thigh is at right angles with the body), or there may be an actual shortening, as in bed-ridden patients with chronic joint disease, in whom the extremities are frequently fixed in a flexed position. Spasticity is characterized by an undue reflex irritability, so that when the foot, for instance, touches the ground, a spasmodic contraction of the calf occurs. It is seen in spinal palsies and after brain hemorrhages. Writer's cramp is a disease characterized by spasm or cramp of the muscles of the hand when attempting to write. Other movements are preserved. It attacks persons who write constantly and for its relief a change of occupation is usually necessary. Cramps of similar character attack typewriters and telegraph operators.

Tremors and Choreiform Movements.—Tremors are an important symptom of nervous diseases. In paralysis agitans there is a tremor which is more or less controlled when the patient makes an effort, whereas in multiple sclerosis the tremor is absent or slight until the patient attempts to do something. In the aged there is a tremor not only of the extremities but also of the head. In exophthalmic goitre and in nervous patients the tremor is fine and rapid. In alcoholism there is a tremor of the lips and tongue in addition to that seen in the hands. Choreiform movements are involuntary, irregular, and excessive in degree. The patient makes queer grimaces, the speech is jerky, and the arms are thrown about in an irregular, purposeless manner. Tics are somewhat similar but are limited to one group of muscles. There is, for example, a twitching of one eyelid. They are usually more or less permanent in affected persons.

Ataxia.—Ataxia or lack of coördination is seen in many diseases, but particularly in locomotor ataxia. The patient lacks the command of the muscles necessary to accomplish particular movements in a normal manner. He cannot touch the tip of his nose with his finger without blundering, his gait is unsteady, and he is unable to stand with his eyes shut.

Reflexes.—The condition of the reflexes is of great importance in the diagnosis of nervous disease. The reflexes are dependent for their development on a normal condition of both the motor and sensory nerves and of the centres. (See Neurons.) Those most commonly determined are the patellar reflex or knee-jerk, the biceps-jerk, ankle-clonus, and certain skin reflexes, particularly the Babinski reflex. The knee-jerk is brought out by tapping the patellar tendon, below the knee. It is necessary for the leg to be relaxed, as when the knees are crossed. The Babinski reflex is elicited by stroking the sole of the foot; this normally causes flexion of the toes, but in the newborn and in certain nervous diseases may cause an extension of the toes.

Special Senses.—The special sense organs are also investigated in nervous and general diseases. The examination of the retina often gives early and positive indications of cerebral disease, arterial disease, nephritis, anemia,



FIG. 4.—Method of eliciting the knee-jerk. (Hare.)

and even tuberculosis. In brain tumor, for example, the condition known as optic neuritis or choked disk is of great diagnostic importance. The state of the pupils and of the external muscles of the eyes, as well as the

conditions of hearing, smelling, and taste, are investigated by suitable methods which we need not consider further.

LUMBAR PUNCTURE.

The spinal canal is frequently punctured, at some point below the termination of the cord, to withdraw cerebrospinal fluid, for purposes of diagnosis, for the relief of intracranial pressure (in brain tumor, hydrocephalus, etc.), or for the introduction of drugs and serums. Thus cocaine, or one of its derivatives, is injected by this route to induce spinal anesthesia, while tetanus antitoxin, salvarsanized serum and antimeningitic serum, are introduced in a similar manner, after spinal fluid in an amount at least equal to that of the fluid to be injected has been withdrawn.

The lower lumbar region, on a level with the crests of the ilia, is "prepared" in advance by the usual technic or disinfected at the time of operation by the aid of soap and water, alcohol and tincture of iodine (or by the latter alone). The patient's back is arched as strongly as possible to separate the vertebræ; this may be accomplished with the patient either sitting or, as is more usual, lying on his side. If he is conscious local anesthesia may be employed—cocaine or one of its derivatives, or the ethyl chloride spray. A moderately large, hollow needle or trocar is then introduced in the middle line, on a level with the third or fourth (second to fifth) lumbar spine, and is pushed forward and slightly upward between the vertebræ for two inches more or less until it enters the bony canal below the level of the cord. As soon as the canal is reached clear fluid will escape, either drop by drop or in spurts, and should be collected in sterile test-tubes.¹ In some cases a coarse wire or stilet will be required to clear the needle of bits of blood clot or tissue. Occasionally the physician may measure the pressure of

¹ In meningitis the spinal fluid is cloudy and contains the causative organism of the disease.

PLATE II



Lumbar Puncture.

Illustrates topography of the parts and method of holding patient. In children the needle is frequently inserted in the middle line. (Koplik.)





the fluid by attaching a graduated glass tube by means of a rubber connection and observing how high the fluid will rise in the tube. The puncture wound is closed by sterile cotton and collodion. After the operation the nurse should watch the patient narrowly for some time to make sure that no untoward symptoms—such as those of collapse—are developing.

CHAPTER II.

MENTAL AND FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM.

MENTAL DISEASES.

Confusional Insanity.
Senile Dementia.
Mania and Melancholia.
Dementia Precox.
Paranoia.
Psychasthenia.
Mental Deficiency.

FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM.

Neurasthenia.
Hysteria.
Infantile Convulsions.
Epilepsy.
Chorea.
Paralysis Agitans.
Neuralgia.

MENTAL DISEASES.

Confusional Insanity.—Certain mental diseases are of common occurrence in medical experience. Others are only remotely related to medical conditions, and do not often come under the observation of the physician or nurse outside of special institutions (psychopathic hospitals).

Subacute or chronic confusion or stupor may follow exhausting illnesses such as typhoid fever, childbirth, or prolonged lactation. Alcoholics are also prone to lapse into a state of stupor with mental confusion after an attack of delirium tremens. These toxic or confusional insanities are characterized, in varying degrees, by delirium, confusion or stupor; there is a failure to recognize friends, loss of the sense of time and place (see Alcoholic Neuritis), forgetfulness, physical unrest, uncleanly habits, etc. The prognosis, particularly after typhoid fever, is good; the symptoms after persisting for weeks or months eventually clear up.

Treatment.—The treatment of insanity, as it occurs after typhoid fever, consists in prolonged mental and physical rest, hypernutrition, and tonics; later hydrotherapy, exercise, and diversion (travel) are of value.

Senile Dementia.—Senile dementia is accompanied by symptoms not unlike those of confusional insanity. Loss of memory is usually the first deviation to be noted. The patients frequently believe that they have been neglected or abused by those nearest of kin. This may lead to domestic misunderstandings. During the day the mental condition may be good, but at night restlessness and noisy delirium are common. Since the disease is due to arteriosclerosis, softening of the brain, or other degenerative changes, the prognosis is practically hopeless.

Mania and Melancholia.—Mania and melancholia are often considered as phases of a single mental symptom-complex (manic-depressive insanity). This type of insanity has little bearing on general medical conditions although it may be accompanied by disturbances of digestion and nutrition. Periods of extreme depression (melancholia), during which the patient desires to be left entirely alone and broods over imaginary faults, *e. g.*, the "unpardonable sin," may alternate with periods of restlessness and excitement (mania), characterized by undue physical activity and an abnormal flow of more or less unrelated ideas. In other cases either mania or melancholia may be dominant throughout. Improvement or even cure is possible; suicide is common and must be kept in mind and guarded against by the nurse or attendant.

Dementia Praecox.—Dementia praecox, the insanity of adolescence, is due in most cases to congenital deficiencies. The patients may be equal to the strain of ordinary life until puberty, or even later, but eventually mental deterioration becomes manifest. They are "disoriented," that is, confused as to time and place, and evince mental perversity by opposition to everything that is proposed by others, or by imitative actions or sounds. Some

patients remain in rigid attitudes for hours at a time (catatonia). I once saw a man with this affection who was so rigid that he could be supported by resting his head and heels on chairs.

Paranoia.—Paranoia or delusional insanity occurs in later adult life. The patient may seem to be perfectly rational in most respects, but harbors some permanent "fixed" delusion which affects his whole "manner of thinking and acting." Many of the assassins of history, *e. g.*, Guiteau, who killed President Garfield, have been paranoiacs who have brooded over and sought revenge for imaginary injuries (delusions of persecution).

Psychasthenia.—Psychasthenia is another type of mental aberration, which, unlike the last two, is closely related to clinical medicine. It will be referred to below under Neurasthenia. General paresis is also described under Nervous Diseases.

Mental Deficiency.—Mental deficiency (amentia) is usually congenital in origin—in contradistinction to insanity which is often acquired—and is frequently associated with physical defects of greater or less degree (dwarfism, *e. g.*). Mental impairment may also be dependent upon disorders of internal secretion as in cretinism or upon cerebral disease, *e. g.*, cerebral softening. The most extreme cases of mental deficiency are known as idiots. They are characterized by almost complete absence of mentality and in many instances by inability to attend to their simplest physical wants. Such persons require almost as much care as newborn infants, while even the least stupid of this type are incapable of an independent existence. Patients with less marked mental defects are designated as "feeble-minded" and are graded according to their capacity in an ascending scale with imbeciles at one end and "morons" at the other. In the case of the latter the mental impairment may not be apparent to the casual observer and the physical development may be nearly perfect. In classifying feeble-minded persons it is customary to speak of them as having a

mental development appropriate to some particular period of childhood. Thus a patient may apparently develop normally until the tenth year but be quite incapable of progressing beyond that point either in the intellectual or the moral sphere.¹ Many of the less marked cases are chiefly notable for their lack of moral sense and from them a considerable portion of the criminal and vicious classes—thieves, prostitutes, etc.—are recruited. Institutional care is essential for idiots and is highly desirable for even the highest grades of morons. The latter are quite capable of useful work under supervision but are prone to fall into want or crime if left to themselves. As they are often highly prolific and transmit their defects to their offspring, it is of great advantage to the community for them to be segregated.

FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM.

Neurasthenia.—Neurasthenia, nervous exhaustion, is brought about by overstrain and exhaustion of the nervous forces or in some cases by chronic toxemia. The strain, whether mental or physical, to which the patient is subjected, may be excessive or, as is more common, the patient may have a low initial resistance. Thus there may be congenital asthenia (literally lack of strength) with structural defects such as flat chest, stooping shoulders, downward displacement ("ptosis") of the stomach, intestines, and kidneys, and in women mal-development or malposition of the uterus. On the other hand, many so-called neurasthenics are fat and rosy. Some of the latter class are hypochondriacs or valetudinarians whose whole attention is focussed on their bodily functions, to the exclusion of other ideas. These are not properly cases of neurasthenia.

Certain cases of neurasthenia manifest distinct mental

¹ The mental capacity of these patients is usually gauged by their ability to cope with definite intellectual tests appropriate to the various age periods (Binet tests).

disturbances, particularly abnormal fears, known as phobias. For example, a dread of open places may develop, so that the patient may be absolutely unable to cross a street or square; others suffer from a similar fear of high places. These symptoms may reach such a degree as to constitute a type of insanity (psychasthenia). Patients with neurasthenia are abnormally introspective, and complain of symptoms which would not attract the attention of a healthy person; even normal sensations are at times interpreted as evidences of serious disease and lead to great depression of spirits.

Symptoms.—The following are a few of the more common symptoms of the disease.

Nervous.—Headache, dizziness, vertigo, indefinite pains, localized areas of tenderness.

Circulatory.—General flushing, sweating, urticaria, pallor, blueness, palpitation.

Gastro-intestinal.—Nervous indigestion, acid eructations, belching, distention, constipation.

Genito-urinary.—Frequent urination, transient polyuria, menstrual disturbances, etc.

A large fraction of all gastro-intestinal disturbances may be traced to neurasthenia, and, conversely, the majority of neurasthenics present digestive symptoms.

Treatment.—The milder, or ambulant cases are usually improved by regulation of the mode of life, by tonics (particularly cold affusions, strychnin, iron, and arsenic), by sedatives (such as bromides, sumbul, and valerian), and by attention to the special local disorders of which the patients complain. Travel, or a long vacation in the country or mountains, is frequently required. In the more aggravated cases the "rest cure" of Dr. S. Weir Mitchell is a most successful method of treatment. The patient is usually isolated in a hospital, or nursing home, under the care of a competent nurse, who must be at the same time firm and kindly. If the nurse is able, during convalescence, to entertain the patient by cheerful conversation or reading so much the better, but medical

and hospital experiences should be strictly tabooed. Absolute rest in bed and exclusion of friends are essential. Many of the symptoms of neurasthenia are aggravated by misplaced sympathy. In order to improve nutrition and accumulate an ample reserve in the form of fat, over-feeding is practised. To spare the digestive and eliminative organs the diet may be at first limited to milk, or skimmed milk, but after a certain time eggs and other bland food may be added. In connection with rest and milk feeding, massage and electricity form a prominent part of the treatment, the purpose being to maintain the nutrition of the muscles during the enforced rest. In the wealthier class of patients these treatments will fall to the masseur or masseuse, in those less able to pay, the trained nurse can fill the gap with success. At the same time the patient is given iron and other tonics. After several weeks a gradual return to normal life is permitted.

Hysteria.—While neurasthenia is almost equally common in both sexes, hysteria is mostly seen in women. Pronounced cases are, however, not unknown in men. Characteristic cases are quite distinctive, but there are many intermediate forms, in which it is difficult to differentiate hysteria from neurasthenia. It is still harder to define in words the difference between the two diseases. Hysteria is a condition of nervous instability and lack of inhibition, rather than exhaustion, in which, according to Osler, "emotional states control the body." The predisposition persists throughout life, but symptoms are more likely to be manifest during adolescence or at the menopause. Faulty education and indulgence may be responsible for, or aggravate this disease. Hysterical patients are cheerful, and suicide, which is not uncommon in neurasthenia, is rare. Their general nutrition is excellent and their color good. They frequently give the impression of being pleased at the commotion which some of their more striking symptoms may provoke. The emotional loss of control, is, as everyone knows,

characteristic—thus laughing and crying may alternate in rapid succession without definite cause.

Hysterical paralysis is not infrequent, and may deceive any but the most expert. Some of the remarkable cures which are wrought at famous shrines and spas are thus capable of explanation. A physician of the writer's acquaintance, who is gifted with a very sympathetic personality, was called upon to treat a case of this sort and effected a startling cure much to his own surprise. He was subsequently besieged by cripples and paralytics, most, if not all, of whom were suffering from incurable organic diseases. Suspicion is usually aroused by the abnormal distribution of the loss of power, which is often unlike that of organic diseases, by the absence of wasting, and by the presence of suggestive symptoms, such as anesthesia. Hysterical convulsions resemble epilepsy, but the movements are sometimes purposeful; unconsciousness is evidently simulated; the tongue is never bitten; the patient always falls in a soft place, and never suffers any injury. Catalepsy—a condition not unlike that seen in dementia precox—is one of the most startling manifestations of hysteria. The limbs may be held rigidly in unusual attitudes for a long time. Anesthesia has been alluded to above. It is frequently strictly limited to one-half of the body, whereas the nerves of sensation really overlap. There are also areas of hyperesthesia and certain definite tender points. The vasomotor nerves are also implicated, giving rise to local or general flushing, pallor, and even hemorrhage.

Treatment.—Patients should be isolated from sympathetic relatives and friends, and treated with tact¹ and decision; their whims and fancies should not be humored. A complete rest cure as described by S. Weir Mitchell will occasionally be necessary. Suggestive therapeutics sometimes produce surprising results; bread pills and hypodermics of sterile water may relieve the severest pain

¹ Dr. Mills advises the nurse not to make the diagnosis of hysteria, and never to employ the term.

or most obstinate insomnia. Hypnotism has not proved to be of any permanent value but certain forms of hydrotherapy occasionally prove of use. The personality and moral influence of the physician or nurse are frequently the most valuable factors in the cure of the patient.

Infantile Convulsions.—In infancy and early childhood convulsions are frequent, and may result from comparatively simple causes, such as rickets, gastro-intestinal disturbances, acute infections and reflex irritation (phimosis, worms, and teething). Intracranial affections such as meningitis, hemorrhage, abscess, and tumor may give rise to convulsions both in childhood and in adult life. True epilepsy takes its origin in later childhood and youth, but nearly 90 per cent. of the cases begin before the thirtieth year. Uremia and puerperal eclampsia are common causes of convulsions in adults. The former may be an occasional cause in infancy.

The convulsions begin with staring of the eyes and twitching of isolated muscles, but the movements of the extremities quickly become general, irregular, and violent, differing very little, if at all, from those observed in epilepsy. The convulsions may be repeated frequently. Holt has seen as many as eighty in one day.

Treatment.—The convulsions should be controlled by the cautious use of chloroform and at the same time a dose of chloral or bromide should be given by the bowel. The tongue should be protected by a cork or piece of wood between the teeth. Cold may be applied to the head and the child wrapped in a towel wrung out of hot mustard water (a tablespoonful to a quart of warm water), or a mustard bath may be given, in which the mustard should be in the proportion of a tablespoonful to the gallon. The temperature of the bath should not exceed 105° and should be tested by a thermometer if possible.

When the attack has been controlled the physician will proceed according to the cause. If the child has eaten indigestible food or has suffered from digestive disturbances, lavage of the stomach and irrigation of the colon

are in order. Emetics and purgatives may be used. The detection of albumin in the urine will point to uremia, while lumbar puncture may determine the diagnosis of meningitis. The treatment will differ with the cause. Children who have once suffered from convulsions are more prone to subsequent attacks, but there is no necessary connection with epilepsy.

Epilepsy.—Epilepsy, as before stated, almost always begins before maturity; it is rarely cured. The mild form is known as "petit mal" and the severe form as "grand mal." The former is often ignored or unsuspected until more severe attacks have supervened. The patient while sitting quietly or conversing will become slightly pallid, and the eyes staring, but in a moment may resume conversation without realizing that he has been unconscious. In other persons major convulsions may occur only at night, and for that reason may be overlooked for a long period. In "grand mal" the patient may have an aura or momentary intimation of the coming attack, for example, the sensation of a flash of light. The attack begins frequently with a wild cry, the patient falls to the ground, the tongue is bitten, and there is frothing at the mouth. At the beginning the limbs are rigid, but almost immediately this tonic phase passes into violent clonic, convulsive movements. The face is swollen and congested, the pupils dilated and fixed and the eyes turned upward. The urine and feces are passed involuntarily. After a few seconds or minutes the convulsions cease, but the unconsciousness which has been present from the first is often prolonged (epileptic coma). When the patient awakes he may feel well except for injury to the tongue. Patients are often severely injured, for example, by falling on the stove, or tumbling from a height. Convulsions may occur many times a day, but once a month, or even less frequently.

Epileptic patients may be normal mentally, but in time deterioration is the rule, in spite of the oft-quoted cases of Caesar and Napoleon. Gastro-intestinal symptoms are

very common and patients are sometimes improved by treatment of their digestive anomalies.

Treatment.—Medicinal treatment is unsatisfactory. A free use of bromides will reduce the frequency of the attacks, but it brings undesirable symptoms in its train—mental torpor, skin eruptions, and digestive disturbances. To secure intensive action bromides are sometimes used to replace common salt in the diet. Epileptics may pursue ordinary occupations with success, but should never be allowed to engage in dangerous trades. The more pronounced cases are best treated in “colonies,” where suitable care and safe occupations may be provided. The diet should consist principally of milk, eggs, cereal foods, vegetables and fruits. During the attack it is necessary to protect the patient from injury, while avoiding restraint as much as possible.

Chorea.—Chorea, or St. Vitus’ dance, is a disease which occurs for the most part in childhood, but occasionally attacks adults, particularly pregnant women. In pregnancy it may be so severe as to induce abortion or miscarriage. Chorea is associated in medical experience with tonsillitis, acute articular rheumatism, and endocarditis, and it is possible, or even probable, that it is an infectious disease, due to the same microorganisms that are responsible for those infections.

Chorea is characterized in its fully developed form by irregular, jerky movements of the extremities, twitching of the facial and other muscles, and resulting disturbance of rest and sleep. There may be a slight fever, but usually this is not a prominent feature. In prolonged or aggravated cases there may be anemia and profound exhaustion. In mild cases, or in the insidious early stages, children are often thought to be nervous, fidgety, or even wilfully clumsy.

Children with chorea should be taken out of school or away from work. If the condition is mild, it may suffice to limit exercise, and to keep them in the open air. In severe cases, rest in bed should be prescribed, as the

movements are much less violent during repose. If endocarditis develops this rest should be prolonged. Salicylates are frequently used in the acute stages, while arsenic, in the form of Fowler's solution is employed in ascending doses throughout the course of the disease. When arsenic is being administered in large or ascending doses, the nurse should watch carefully for indications of poisoning such as loss of appetite, nausea, diarrhea, colic, puffiness about the eyes in the morning, skin eruptions or disturbances of sensation (complaint of numbness or tingling). If such are noted they should be immediately reported to the physician. Quinin has also been used to control the choreiform movements.

There are other forms of chorea occurring in adults which are, however, entirely independent diseases. As they are rare, we will not concern ourselves with them further.

Paralysis Agitans.—Paralysis agitans, or the "shaking palsy," is a disease of the aged characterized by a fine tremor, general muscular rigidity, and a peculiar gait. The tremor does not usually involve the head, and becomes less with repose. The muscular rigidity causes the face to become expressionless, the body is bent forward, and the arms flexed at the elbows. When the patient walks he has a tendency to go faster and faster and finally to fall forward, but usually saves himself by stopping short. In advanced cases there is distinct loss of power. The tremor of old age is somewhat similar, but involves the head particularly. The disease in itself is not fatal, but is incurable. Any treatment should be directed to improving the nutrition of the patient by means of tonics, massage, and hydrotherapy.

Neuralgia.—Neuralgia is a term which is applied to a paroxysmal pain in the course of one of the sensory nerves, for which there is no obvious explanation. The pain is sharp and shooting, but not constant. It is limited to a single nerve and its branches, or, at most, to a few nerves. Neuritis, on the other hand, is characterized by

inflammatory changes affecting either the sensory or motor nerves, or their sheaths; if the sensory or mixed nerves are affected there is pain, but this is less severe and more constant than that of neuralgia. It is accompanied by tenderness in the course of the nerve, whereas in neuralgia, tenderness, if present at all, is limited to certain definite points where the nerve makes its exit from the bony canals. In neuritis, if the motor nerves are attacked, there will be a flaccid paralysis, usually with absence of reflexes.

Neuralgia is a common condition in persons who are neurasthenic, anemic, or "gouty," using the latter term in a popular sense to include a number of obscure toxic conditions. It may also be reflex, as from carious teeth, or local pressure. In one patient a persistent intercostal neuralgia was attributed to neurasthenia until an x-ray showed a small bony outgrowth from a rib pressing on the nerve. After the bony nodule was removed, the neuralgia disappeared. In another case a severe sciatica was found to be dependent upon a sarcoma of the sacrum involving the origin of the nerve.

Neuralgia may affect any of the sensory nerves, but the following forms are especially common and severe: trigeminal neuralgia, sciatica, brachial neuralgia, and intercostal neuralgia. Trigeminal neuralgia or tic douloureux affects one or more of the three branches of the fifth cranial nerve: the first, supplying the forehead and eye; the second, the upper jaw, and the third, the lower jaw. The disease may begin in one branch and afterward attack the other branches, or it may be limited to one branch throughout. In its severest forms this is probably the most painful affection in the whole realm of medicine, and victims of the disease are willing to submit to any operation, however severe, to obtain relief. Many cases, however, are comparatively mild. Sciatica is usually neuralgic in character, but there is sometimes distinct neuritis. True sciatica is almost always unilateral, whereas bilateral pain is more likely to be due to some

intrapelvic pressure. Tumors and bony outgrowths, such as are found in arthritis deformans, are the common causes of such pressure. Intercostal neuralgia is characterized by pain at the exit of the nerve near the spine and anteriorly where it comes forward and becomes superficial. In intercostal neuritis tenderness is found along the whole course of the nerve; in pleurisy and in myalgia the pain is more diffuse and in pleurisy accompanied by the signs of that disease.

Treatment.—The management of neuralgia is concerned, first, with the discovery of the cause and its removal, and secondly, with symptomatic treatment. Under the first heading would come the removal of bad teeth and the treatment of anemia, or of rheumatic and gouty conditions. Palliative treatment embraces the use of a large number of drugs, most of them too well known, of which phenacetin and morphin may be taken as types. The latter is an extremely dangerous drug to use in this condition (formation of habit) and only very exceptional reasons would warrant its use. Local measures are frequently helpful. These include medicated ointment, hot applications, blisters, actual cautery, and, rarely, electricity. In *tic douloureux*, after other measures have failed, injections of alcohol into the nerves sometimes give at least temporary relief. If this fails the several branches may be cut in succession. Finally, the Gasserian ganglion itself may be removed. This is an extremely severe and mutilating operation.

CHAPTER III.

ORGANIC DISEASES OF THE NERVOUS SYSTEM.

NEURITIS.

Facial Palsy.

Pressure Paralysis.

Toxic Neuritis.

Multiple Neuritis.

CHRONIC POLIOMYELITIS.

HERPES ZOSTER.

MYELITIS.

DISSEMINATED SCLEROSIS.

LOCOMOTOR ATAXIA.

GENERAL PARESIS.

CEREBROSPINAL SYPHILIS.

MENINGITIS.

HEMIPLEGIA.

HEMORRHAGE, THROMBOSIS, AND
EMBOLISM.

SUBDURAL HEMORRHAGE.

HYDROCEPHALUS.

TUMORS OF THE BRAIN.

ABSCESS OF THE BRAIN.

Neuritis.—The diseases thus far considered have been largely functional in nature. In neuritis, as mentioned under Neuralgia, there are well-marked pathological changes. Neuritis may be localized, affecting any one of the cranial or spinal nerves, or there may be a more or less general involvement of many nerves, the so-called multiple neuritis. Simple neuritis is frequently due to injury (for example, pressure), exposure to cold, etc. Multiple neuritis is usually the result of some toxin or poison. Thus it may be due to certain infections such as diphtheria, influenza, and leprosy, to metabolic poisons as in gout and diabetes, and finally, to extraneous poisons, the most important being alcohol, lead, and arsenic. The neuritis of beriberi is probably consequent on a deficiency in certain nutritive principles ("vitamins") in the diet and not the result of infection as formerly believed. A few of the common varieties of neuritis will be briefly described as types.

Facial Palsy.—Bell's, or facial palsy, affects the seventh cranial (facial) nerve on one side, and usually begins suddenly without obvious cause other than exposure to cold ("draught"). There is no pain, but the side of the

face affected is smooth and expressionless. The eye cannot be completely closed, the mouth is drawn to the opposite or healthy side, food collects in the cheek, and the saliva flows from the corner of the mouth. In some cases there is loss of taste. It is possible to determine what portion of the nerve is affected by the presence or absence of this or other symptoms. After a few weeks the paralysis usually clears up. This does not apply, however, to cases which are due to some distinct injury, such as may occur, for example, in the course of operations for mastoid disease.



FIG. 5.—Facial palsy. The affected side of the face is smooth and the eye cannot be completely closed. (White and Jelliffe.)

Pressure Paralysis.—Drunkards frequently go to sleep with their heads on their arms, and on awakening are found to have a paralysis of the extensor muscles of the forearm, causing unilateral wrist-drop. In this instance pressure on the nerve trunk is the obvious cause of the neuritis. A similar palsy may result from the pressure of shoulder braces or straps during prolonged operations (Trendelenburg position). In the latter case the deltoid muscle is most often affected.

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Toxic Neuritis.—Diphtheria is followed by symptoms of neuritis (diphtheritic paralysis) in more than 15 per cent. of the cases. Symptoms may be very slight, being limited to nasal voice, double vision, and weakness of the extremities (loss of knee-jerks), or, as is more usual, there may be marked difficulty in swallowing, with regurgitation of food through the nose, due to paralysis of the muscles of the soft palate and pharynx. In the severest cases the paralysis may affect the muscles of respiration, and even the heart. In the latter case the nerve which controls the heart, the vagus, is probably involved. Death may occur very suddenly from heart or respiratory failure, but recovery is the rule.

Lead neuritis is usually found in painters and white lead workers, but there is a multitude of occupations in which exposure to the poisonous action of this metal is possible. Patients may have had lead colic, or the neuritis may be the first manifestation of the disease. The poison usually picks out certain groups of muscles. The most common variety is wrist-drop, which in this case is bilateral. The upper arm, the legs, and the eyes are also more or less commonly affected.

Arsenical neuritis is less common. It occurs occasionally from too prolonged medicinal use of Fowler's solution or other arsenical preparations, as in a case of pernicious anemia, which I saw last year, or it may be due to an accidental contamination of foods, beverages, wall papers, etc. Arsenical neuritis is characterized by peculiar changes in the skin, particularly thickening and pigmentation.

Multiple Neuritis.—The commonest form of multiple neuritis is that due to alcohol; usually the etiology is obvious, but occasionally cases are seen in women who have been secret toppers. Alcoholic neuritis is characterized by involvement both of the sensory and motor nerves. The patients complain of numbness, tingling, burning, and other abnormal sensations (paresthesia) in the limbs and are frequently attacked by severe muscular cramps which may compel them to jump out of bed.

In fully developed cases of multiple neuritis the patients are helpless, with paralysis of the extremities and double wrist- and foot-drop. The muscles waste away and the reflexes are lost. There is usually tenderness over all the nerve trunks and the muscles are sensitive. The skin may be glossy and even edematous. When the patient is able to walk he lifts his feet high so that his toes will not scrape the floor. In certain alcoholic cases mental symptoms may develop, with loss of memory, and confusion as to time and place. Such patients, in addition, frequently describe recent experiences which have no basis in fact. These more severe cases frequently die, but the majority of patients slowly recover when the alcohol is withdrawn.



FIG. 6.—Multiple neuritis. Double wrist-drop and double foot-drop. (Lloyd.)

Treatment.—The more severe forms of multiple neuritis are treated by rest in bed. Splints, sand-bags, etc., are employed to maintain the correct position of the limbs and to prevent the development of permanent contractures. In many cases it is wise to put the patient upon an air-bed to avoid the possibility of bed-sores, which are prone to develop because of interference with the normal trophic influences. During the acute stage the local measures mentioned under Neuralgia are usually employed, particularly heat. In convalescence passive movements, massage, and electricity are all of great value. In this stage strychnin may be used in large doses

for its effect on the muscles. It is obvious that in all cases the cause should be removed whenever possible. The diet should be liberal, except in certain constitutional conditions, in which suitable restrictions may be necessary.

Chronic Poliomyelitis.—In poliomyelitis the disease process does not affect the motor nerves themselves but the cells in the anterior part of the spinal cord which control their nutrition. (See Lower Neurons.) The injury to the ganglion cell may be slight or there may be total destruction. In the latter case the nerve degenerates, the muscles it supplies become paralyzed and atrophied, and the reflexes are lost. Acute poliomyelitis is due to infection and will be discussed under Infectious Diseases. Chronic poliomyelitis, or *progressive muscular atrophy*, occurs in middle life and is characterized by atrophy of the ganglion cells of the anterior horns of the spinal cord. The upper extremities are usually symmetrically involved. The muscles, particularly the smaller muscles of the hands, slowly waste away, so that the latter finally come to resemble claws. The muscles of the lower limbs, chest, throat, face, etc., are not involved until late in the disease. There is a type known as glossolabiolaryngeal (!) paralysis, in which the muscles of the tongue, lips, pharynx, and larynx are principally involved. The ordinary form of chronic poliomyelitis is not in itself fatal. The last-named type, on account of interference with swallowing and respiration, is usually far more serious.

Herpes Zoster.—If the ganglia on the posterior or sensory roots are involved, a condition known as herpes zoster develops. This is characterized by neuralgic pains in the area supplied by the affected segment of the spinal cord, followed in a few days by the localized eruption of blisters or vesicles surmounting an area of inflammation. The pain is frequently very severe, and in the weak and aged I have seen burning and other abnormal sensations persist for many months after the disappearance of the eruption. The vesicles may appear in the course of any sensory nerve (more accurately in any area supplied by an

affected spinal segment), but are commonly seen on the lateral aspect of the chest. They may also appear on the upper arm, on the forehead, etc. The disease is almost invariably limited to one side. The ordinary herpes on

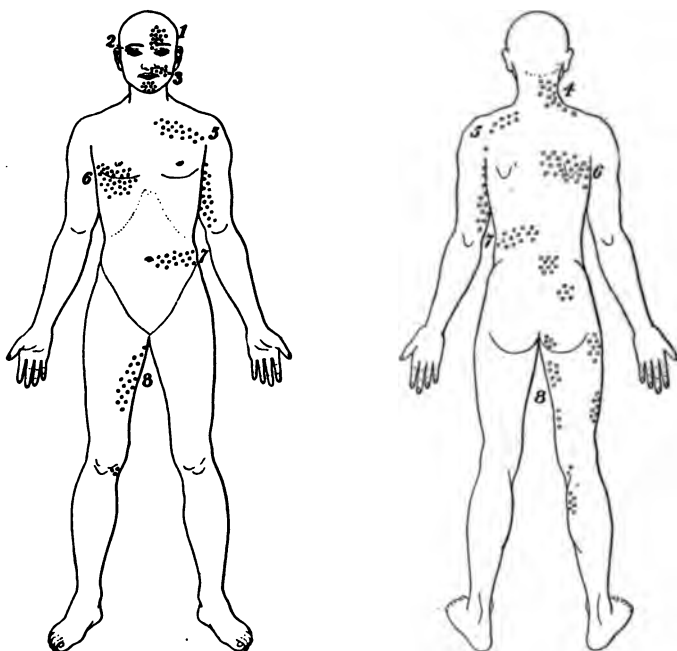


FIG. 7.—Herpes zoster. Diagram showing different positions in which the eruption may occur. These areas correspond to the distribution of certain nerves or to definite spinal segments; 6, 5, and 1 are the most common types.

the lips and nose, seen in pneumonia, malaria, meningitis, and common colds, is probably due to toxic injury of minute nerve filaments.

Treatment.—There is no treatment for chronic poliomyelitis, aside from general hygienic measures. Herpes zoster is also uninfluenced by treatment except in a palliative sense. Sedatives in the form of dusting powders,

ointments, or solutions in collodion, may be applied along the affected nerve. After the disappearance of the eruption, electricity in the form of galvanism will sometimes relieve neuralgia.

Myelitis.—Myelitis is a term applied to inflammation or softening of the spinal cord. This may occur in both acute and chronic forms, and may involve the cord throughout, or be limited to one level. The latter form is called transverse myelitis and may be compared in its effect to a cutting across of the cord. This results in a paralysis of all the muscles below the area of disease, with anesthesia. The superior centres are cut off so that the affected muscles ultimately become stiff or spastic and the reflexes are increased. As a rule the patient experiences a "girdle" sensation at the level of the disease. With the paralysis there is loss of control of the rectum and bladder, with incontinence or retention of urine, and incontinence of feces, or obstinate constipation. In the severe cases, in which loss of power is complete, the patient is confined to his bed and is subject to the dangers of bed-sores and cystitis.

Symptoms.—The onset is frequently rapid and may be attributed to injury, tumor, or disease of the bones, but more commonly to nothing more definite than exposure to cold or wet. In the latter case some infection or toxemia is usually responsible for the condition. Early symptoms are numbness, tingling, and a sense of weight in the extremities. The course, depending on the cause, may be short or extremely chronic. There are a great many varieties of the disease which cannot be considered in this brief survey.

Treatment.—The treatment of bed-ridden patients requires the greatest care on the part of the nurse or attendants. The patient should be kept scrupulously clean and should be frequently turned to avoid any danger of bed-sores. An air- or water-bed is to be preferred. Particular attention must be directed to the prevention of irritation from incontinence of urine and feces. Absorb-

ent cotton, oakum, or specially adjusted bed-pans and urinals, one or all, may be employed with advantage for this purpose. When catheterization is necessary, careful asepsis will be required to prevent cystitis. Massage and passive movements are necessary and useful to maintain the nutrition of the muscles. In some cases, after prolonged invalidism, great improvement occurs; in the majority the prognosis is not very hopeful. In mild cases the paralysis is never complete and the patient may be able to get about.

Disseminated Sclerosis.—Spinal sclerosis is characterized by fibrous changes in the cord which may injure either the motor (*e. g.*, lateral sclerosis) or the sensory (*e. g.*, locomotor ataxia) tracts, or may affect both. Disseminated or multiple sclerosis is a disease in young adults, characterized pathologically by small areas of fibrosis widely scattered through the brain and cord. The cause of the disease is unknown. It begins with weakness in the legs with subsequent loss of power and spasticity. The reflexes are increased. In typical cases there is tremor upon effort, lateral oscillation of the eyeball (nystagmus), and a peculiar form of speech in which the syllables are stressed as in scanning. The disease is very chronic and may ultimately lead to considerable loss of power and mental deterioration.

Locomotor Ataxia.—Locomotor ataxia and paresis, though diverse in their manifestations, are closely related in their causation. Both are the ultimate results of syphilis and the difference in the symptoms presented is owing to the localization of the diseased process. In locomotor ataxia the spinal cord is principally affected; in paresis (as general paralysis is commonly termed) the brain bears the brunt of the disease. There are occasionally cases of so-called "taboparesis," in which these conditions overlap, but usually they are distinct.

Locomotor ataxia is so-called because of the peculiar disorder of gait which characterizes it. The synonym "tabes," refers to the "wasting" or sclerosis of the pos-

terior or sensory columns of the spinal cord. The disease is very insidious in its onset and attention may be first called to it by the occurrence of so-called "crises" or "lightning" pains felt in the larynx, the internal organs (stomach), or the extremities. Sometimes the first symptom noticed by the patient is inability to walk in the dark, or staggering when he attempts to wash his face. On questioning, he will usually complain of peculiar sensations in the feet, as if he were walking on cotton, and sometimes of abnormal sensations in the rectum. The knee-jerks, on examination, are found to be very much diminished or absent. The pupils are small and do not respond by contraction on exposure to a strong light. They do get smaller, however, when the patient looks at some near object. Sometimes loss of vision or double vision is an early symptom. If the patient is asked to touch the tip of his nose with his finger, or one knee with the heel of the opposite foot, he has difficulty in doing it quickly and accurately. If he stands with his eyes shut, he sways, or even falls. When he walks he lifts his feet high and separates them widely, so as to be sure of not stumbling or falling. This is due in part to the fact that the sensation in the feet has been impaired, so that he is dependent on sight to maintain his equilibrium. The disease is extremely chronic; after a lapse of possibly twenty years or more, the patient may become bed-ridden and paralyzed, and suffer from incontinence of urine and feces. Finally, mental symptoms supervene. Death occurs from exhaustion or from some accidental disease. The excruciating pain suffered by some of these patients drives them at times to suicide, as happened in two cases with gastric crises which I had under observation. In addition to the complications already mentioned, trophic conditions, including perforating ulcer of the foot and degenerative changes in the joints (knee, as a rule), are seen.

Tabes is rare in the colored race; it is far more common in men than in women. The disease is incurable, but is

frequently stationary for long periods of time and susceptible to great improvement by treatment.

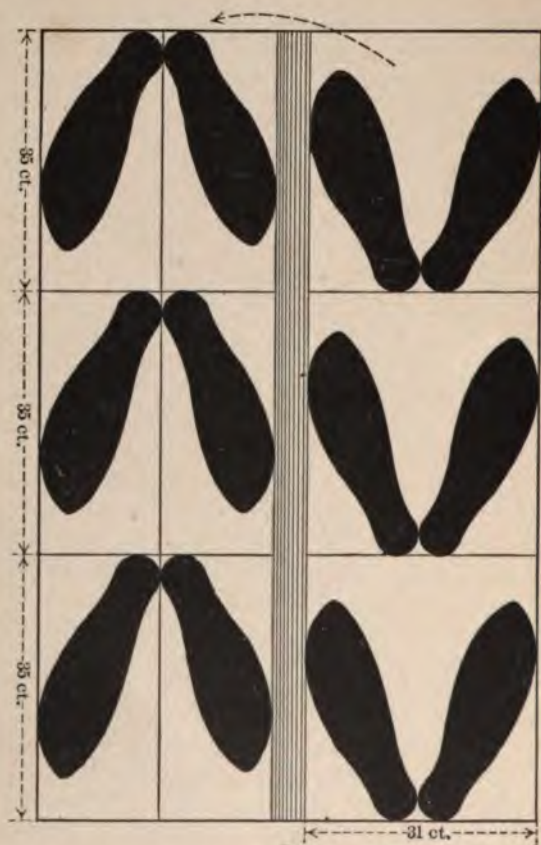


FIG. 8.—Footprints on floor for practice in walking. (White and Jelliffe.)

Treatment.—Treatment is chiefly by physical measures; it is doubtful if medical treatment is of any value. The disease seems to have progressed beyond the reach of ordinary syphilitic treatment, although the exact value of the newer remedies (salvarsan, etc.) has not yet been

fixed. The physical measures consist largely in reëducation of the muscles, so that precision of movement may be restored. Other sense organs are educated to take the place of the impaired sensory nerves. The patient practices walking a chalk line, putting his feet into ruled spaces, inserting pegs into holes, etc.

General Paresis.—In general paralysis of the insane, as this disease is more explicitly called, mental symptoms predominate, though evidences of paralysis may exist long before the former are apparent. The pupils are contracted and usually irregular, the face is immobile, and there is an irregular tremor of the tongue, so that the enunciation is indistinct. Tremor of the hands leads to characteristic changes in writing. In the early stages in addition to the symptoms already noted, the patient exhibits changes in conduct and character. He becomes careless in his personal habits; unreliable in business, and perverted in the moral sphere. With further development of the disease, delusions of importance or grandeur become dominant, he becomes extremely extravagant and engages in foolish business ventures in which his fortune, if he has one, is sometimes lost. Finally, the mental powers begin to wane and the case progresses to complete dementia. At the same time the paralysis becomes more and more extensive until the patient is helpless, unable to feed himself and with no control over his sphincters (incontinence of urine and feces). Bedsores frequently develop and complicating diseases are not at all unusual.

Treatment.—Treatment is largely institutional, principally directed to the care, comfort, and protection of the patient. If the case is recognized at a very early stage the patient may be placed in the care of a nurse, or other attendant, and the course of the disease may be somewhat retarded.

Cerebrospinal Syphilis.—Under this heading we include a large number of cases which are more directly due to the syphilitic virus than tabes and paresis. This disease may attack the small bloodvessels causing obstruction

to the circulation and consequent injury to the nervous tissue; there may be patches of meningitis causing localized pressure on the brain or cord; or finally tumor-like masses known as gummata may be the exciting factors in producing the symptoms. The symptoms, as may be easily imagined, are as diverse as the distribution of the lesions which give rise to them.

If the disease attacks the brain, there may be mental deterioration, and in many cases paralytic phenomena. If a gumma is present, the symptoms of brain tumor, as described later on, will be manifest. When the cord is invaded, there will be, in addition to inequality of the pupils, loss of power, rigidity, spasm, and increased reflexes.

In cerebrospinal syphilis, tabes, etc., lumbar puncture is of considerable importance; the fluid which is obtained shows a characteristic increase of certain cells (lymphocytes).

Treatment.—In early cases, particularly in gumma of the brain, brilliant results are often obtained by the use of inunctions of mercurial ointment, large doses of potassium iodide, or intravenous injections of salvarsan or neo-salvarsan. The technic of the last-named procedure will be described subsequently. (See Syphilis.)

Meningitis.—Meningitis may attack the membranes either of the brain or cord, but generally both are involved at the same time; hence we speak of cerebrospinal meningitis. Syphilitic meningitis of the cord and of the brain has been mentioned. Other forms of local meningitis may depend on injury or abscess. Cerebrospinal meningitis may be due to tuberculosis. It is a frequent terminal infection in miliary tuberculosis, and in chronic bone and joint tuberculosis. It is also common in children without obvious cause. True tuberculous cases are almost invariably fatal. In children the disease may begin with irregular fever, irritability, increasing stupor, and convulsions. In the early stages a child may utter sharp cries which are characteristic when once heard. In the stage of coma, extreme degrees of retraction of the head, with curving of the back (opisthotonos), are seen. The

disease may last for several weeks, and emaciation become excessive. It is sometimes spoken of as acute hydrocephalus on account of the increase of fluid in the cavities of the brain, but it has nothing to do with the chronic disorder of the same name.

Epidemic cerebrospinal meningitis is due to a specific organism and will be discussed with the infectious diseases. Similar symptoms result from infection with a variety of microorganisms which are not specific to this disease, the most important being the pneumococcus and the streptococcus. In the pneumococcic variety the disease may be associated with pneumonia. The prognosis in all these types is serious but not absolutely hopeless.

Hemiplegia.—Hemiplegia or paralysis of one side of the body is commonly due to hemorrhage or softening, but the converse is not true, as hemorrhage or extensive softening may exist without paralysis. The manifestations depend upon the situation of the lesion. Certain areas of the cortex, or gray matter investing the brain, control the motor functions, while others have to do with psychic and sensory functions. The fibers that come from the motor areas of the cortex are arranged on either hand like the ribs of a palm leaf fan (Fig. 9). They converge near the base of the brain, pass through the narrow spaces on each side known as the internal capsules, into the peduncles (or stems) of the brain, and then unite with their fellows from the opposite side to form the medulla and spinal cord. The peduncle corresponds to the handle of the fan. In the pons and medulla, the majority of the fibers pass over to the opposite side and end about the nuclei (cranial nerves) in that region, or pass downward and end about the motor cells in the anterior gray matter of the spinal cord. A few fibers pass directly into the spinal cord, and cross over in a similar manner lower down. The above-mentioned nuclei and cells form a part of the lower motor neurons and belong to the cranial and spinal nerves respectively. The former supply the eye and its muscles, the face, tongue, etc., and the latter, the muscles of the trunk and extremities.

The arrangement of the circulation of the brain is such that the arteries which supply the internal capsules are

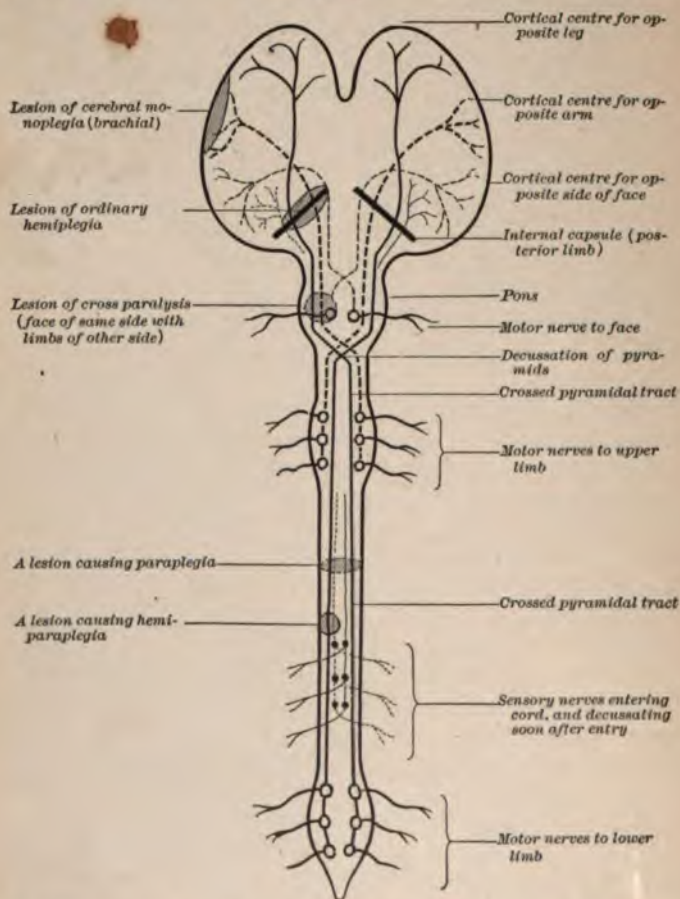


FIG. 9.—Diagram showing the general arrangement of the motor tract and the effect of lesions at various points. (Ormerod.)

peculiarly liable to disease and rupture, particularly on the left side, causing localized hemorrhage or clotting in the vessels (thrombosis). Emboli (floating particles)

in the blood are also likely to lodge in this region. A lesion in the internal capsule destroys the motor fibers on that side and causes paralysis on the entire opposite side of the body, with the exception of certain muscles of the face and forehead which have a nervous supply from both sides. A similar injury in the pons will cause paralysis of the arm and leg on the opposite side, plus paralysis of the muscles controlled by one or more of the cranial nerves on the same side (paralysis of the face). This is explained by the crossing of the fibers described above.

Hemorrhage, Thrombosis, and Embolism.—Cerebral hemorrhage is found as a rule in those past middle age, because in them the vessels are prone to be weakened by arteriosclerosis. High blood-pressure which frequently accompanies arteriosclerosis and nephritis increases the liability to this accident. Thrombosis may occur at any age. Typically it is characterized by a more gradual onset of paralysis and unconsciousness, but the differentiation is probably not as easy as is often supposed. Embolism occurs frequently in younger persons, particularly in infectious diseases, in the course of acute and chronic endocarditis, and in aneurysm. It is due to fragments of clots, or vegetations from inflamed valves, getting into the blood and plugging the terminal arteries in the brain. It leads to localized clotting (thrombosis) and softening. In many cases hemorrhage or softening which was at first of small extent may be succeeded by secondary hemorrhage causing widespread paralysis and death.

The attack comes on suddenly, usually without premonition, but is sometimes preceded by vertigo, numbness, or convulsions. The patient is deeply unconscious (comatose), the extremities are relaxed, the pulse is full and strong, and the respiration deep and snoring (stertorous). On careful examination the arm and leg on one side are usually found to be more relaxed than on the other, one side of the face is puffed out in breathing, the pupils are unequal. At this stage there is difficulty in distinguishing the attack from alcoholism, of

poisoning, or head injuries, unless the previous history of the patient is known.

In fatal cases the patient passes into deeper coma, and loud, bubbling rales presage the development of edema of the lungs. In those less serious, consciousness gradually returns and the distribution of the paralysis becomes evident. When the paralysis is on the right side the patient may at first be unable to express himself (aphasia), but in time speech is usually recovered. Recovery may be due to relief of pressure, etc., or to the education of the centres on the opposite side. In left-handed persons paralysis of the right side is not accompanied by aphasia.

In convalescence the leg recovers more rapidly than the arm, but some loss of power usually persists. Wasting, except from disuse, does not occur, because the disease is in the upper motor segment and leaves the ganglion cells which control nutrition uninjured. The reflexes on the affected side are increased. When the patient walks he swings the affected leg from the hip and supports the paralyzed arm with the opposite hand. Elderly patients who have suffered one stroke are liable to subsequent attacks. Sometimes these may be very slight, and it is not rare for the patient to die of some complicating disease.

Treatment.—If the patient is found in the comatose state, he should be placed in bed with the head elevated. If the clothing is tight it should be loosened; cold may be applied to the head and heat to the extremities. If the pulse is full and the blood-pressure high, it is good practice to bleed the patient freely with the purpose of lowering the blood-pressure and checking the hemorrhage. At this stage croton oil, 1 minim, or elaterin, $\frac{1}{20}$ grain, is frequently administered to produce purgation. The treatment in other respects is symptomatic. During convalescence massage may be of some use in maintaining the nutrition of the muscles until their functions are restored. Careful nursing is necessary to avoid the formation of bed-sores. Patients should be tilted from side to

side to prevent congestion of the dependent portions of the lungs. In the early stages care should be used in the administration of food, as there is danger of aspiration pneumonia, from solid particles "going down the wrong way."

Subdural Hemorrhage.—Any circumstance which will cause a rupture of one of the bloodvessels on the surface of the brain will give rise to hemorrhage beneath the membranes and, if this is not too extensive, to localized pressure. Such hemorrhages are common in surgical practice as the result of injury. In medical practice we see them most often in children, sometimes as a result of birth injuries, at other times in consequence of excessive congestion, such as occurs in whooping-cough or convulsions. The pressure is likely to involve parts of the motor area, and leads either to hemiplegia or monoplegia, more often the latter. Thus if the arm centre is pressed upon, there is paralysis of the corresponding member (see diagram). At first the paralysis may appear to be very extensive but it usually clears up to a certain degree. Subsequently the affected limb ceases to grow, becomes stiff and rigid, or exhibits peculiar, slow, spasmodic ("athetoid") movements.

Treatment.—Treatment consists in an effort to restore function in the temporarily affected muscles by massage and electricity, and in the prevention or correction of deformity by orthopedic apparatus and operations.

Hydrocephalus.—Hydrocephalus or "water on the brain," is a term used to designate an increase of fluid in the ventricles or cavities of the brain. This may be due to many causes: meningitis, tumors, and the atrophy of old age. In the last named the fluid takes the place of the shrunken brain substance; in the others the accumulation is due to obstruction which prevents the normal drainage of the cerebrospinal fluid into the spinal canal.

The disease usually designated by this name, however, is *chronic congenital hydrocephalus*. Children affected with this disease have large, rounded heads and relatively small, narrow faces. There may be some weakness in the

extremities. The mind may be clear, or there may be a certain degree of mental impairment. As the condition begins before birth, it may interfere with labor, and sometimes the spinal cord or the ventricles have to be drained to permit delivery. Hydrocephalic children are usually weakly and do not often survive to adult life. In some cases lumbar puncture has been of great benefit. Aside from this there is no treatment.

Tumors of the Brain.—Syphilis may give rise to gummata which present all the signs and symptoms of brain tumor. Unlike other tumors they are amenable to treatment. Benign and malignant growths also occur, and produce, first, symptoms common to all brain tumors, and second, localizing symptoms, depending on the situation of the growth. The primary symptoms of brain tumor are headache, vomiting, and optic neuritis ("choked disk"). The latter refers to inflammation and swelling of the optic disk or nerve head (as viewed through the ophthalmoscope), due to increased intracranial pressure. Localizing symptoms include disturbances of the various senses, paralyses, vertigo, disturbances of gait, etc.

Abscess of the Brain.—Abscess of the brain produces symptoms which may be similar to those seen in tumor, but are more sudden in onset, and are accompanied by fever, leukocytosis, and the signs and symptoms of the primary disease. Abscess of the brain is usually due to disease of the middle ear and mastoid, or to infection from the nose and its sinuses.

Treatment.—If an accurate localization can be made, and the tumor is in a situation where it can be safely reached, removal is often attempted by a trephining operation. In other cases trephining and drainage (decompression) are undertaken to relieve the intense headache and to save the eye-sight. This operation is a palliative one only. In brain abscess, operation is more urgent, as it may be a life-saving measure and usually offers the only hope of saving the patient's life.

PART II.

DISEASES OF THE BLOOD AND GLANDS.

DISEASES OF THE BLOOD.

General Considerations.

Anemia.

Chlorosis.

Pernicious Anemia.

Splenic Anemia and Polycy-

themia.

Leukemia.

Hodgkin's Disease.

Purpura.

Hemophilia.

DISEASES OF THE LYMPHATICS AND LYMPHATIC GLANDS.

DISEASES OF THE DUCTLESS GLANDS.

Simple Goitre.

Myxedema and Cretinism.

Exophthalmic Goitre.

Thymic Asthma, Thymus Death,
etc.

Addison's Disease.

Infantilism and Acromegaly.

DISEASES OF THE BLOOD.

General Considerations.—Pallor of the skin is not a trustworthy evidence of anemia, as persons with thin, delicate skins may have a rosy hue, although the blood is decidedly impoverished, while in thick-skinned persons the opposite is true. The color of the mucous membranes, lips, tongue, and conjunctiva, is a more reliable index of the condition of the blood.

The color of the blood may be roughly estimated by comparing a drop of the patient's with a drop of the examiner's blood on a handkerchief, or a printed scale of colors may be used for more accurate comparison. Physicians commonly employ some form of hemoglo-

binometer for this purpose. One of the simplest is that of Sahli which consists of two tubes, one containing colored fluid as a standard and the other a measured quantity of the blood to be tested and sufficient diluting fluid to make the tubes look alike. When the tubes match perfectly the percentage of hemoglobin may be read off on the scale.



FIG. 10.—Sahli's hemoglobinometer. (Simon.)

Blood counts are made by diluting the blood in graduated pipettes, and then counting the cells under a microscope. For this purpose a drop of the diluted blood is placed on an accurately ruled slide, "counting chamber," and covered with a glass slip. From the figures thus



FIG. 11.—Blood counting chamber (ruling). (Simon.)

obtained the number of cells in a cubic millimeter is calculated. Usually the number of red corpuscles varies from four to five million. In the "severest" anemias the number of "reds" may fall below one million. The white blood cells usually number from eight to ten thousand. In typhoid fever and measles they are reduced below this minimum (leukopenia) but in most infections, *e. g.*, pneu-

PLATE III

BLOOD

(Ehrlich triple stain.)

(Prepared by DR LYON.)

Fig. 1



TYPES OF LEUKOCYTES.

a. Polymorphonuclear neutrophile. *b.* Polymorphonuclear eosinophile. *c.* Myelocyte (neutrophilic). *d.* Eosinophilic myelocyte. *e.* Large lymphocyte (large mononuclear). *f.* Small lymphocyte (small mononuclear).

Fig. 2



DRAWN BY J. H. CHASE

VARIETIES OF RED CORPUSCLES.

a. Normal red corpuscle (normocyte). *b, c.* Anemic red corpuscles. *d-g.* Poikilocytes (irregular cells). *h.* Microcyte (small cell). *i.* Megalocyte (large cell). *j-n.* Nucleated red corpuscles. *j, k.* Normoblasts. *l.* Microblast. *m, n.* Megaloblasts.

monia, they are increased to fifteen, twenty, thirty thousand, or more (leukocytosis). The greatest increase is seen in leukemia ("white blood") in which disease they may be numbered by the hundred thousand. To make a "differential" count, a drop of blood is spread upon a slide or cover slip and stained, after which the various kinds of white blood cells are noted and recorded in percentages. In normal blood of adults, about 70 per cent. of the white cells have irregular nuclei and fine granules which stain a purplish color with ordinary stains—these are known as polymorphonuclear cells. The small lymphocytes, which have regular, deeply stained nuclei and no granules, constitute about 25 per cent. of the cells. The remaining cells consist of large cells with single nuclei (large lymphocytes), and cells with large, bright pink granules (eosinophiles). The latter, which normally do not much exceed 1 per cent. are increased in certain diseases (*e. g.*, trichinosis). In leukemia special cells known as myelocytes make their appearance. The red cells are also inspected for the detection of changes suggestive of anemia, etc. The normal red cells are of a uniform size and color but in anemia they may be pale (throughout or in the centre), irregularly stained, or variable in size and shape. Sometimes in severe anemias some of the red cells may be nucleated. Large nucleated red cells (megablasts) are characteristic of pernicious anemia.

In acute secondary anemia (hemorrhage) and rarely in pernicious anemia it may be necessary or wise to attempt to supply the deficiency in the volume of the blood by hypodermoclysis, intravenous infusion, direct transfusion, or enteroclysis. These measures are also of value in "shock," in uremia (when combined with venesection), in toxemias, and in infections. In the operation of hypodermoclysis a pint or more of fluid (usually physiological salt solution) is injected into the loose connective tissue beneath the breasts, in the axilla or elsewhere. These injections may be and often are repeated. The operation

is very simple and no apparatus is required except a large hypodermic needle and a fountain syringe. The most scrupulous cleanliness and asepsis is, however, essential as the infiltrated tissues seem to be prone to infection. I have seen severe and even fatal consequences follow this simple operation. In the operation of intravenous infusion a large vein, usually at the bend of the elbow, is laid bare by incision and careful dissection. Ligatures are placed about it, above and below, and the lower one is tightened. The intravenous needle, which has a dull, flanged tip, is introduced through a slit in the vein, in the direction of the heart and the upper ligature is tied about it. The salt solution, since it goes directly into the circulation, should be accurately made, sterile, and not below the temperature of the blood, 98° to 100°. When sufficient fluid has been introduced, the needle is removed, the upper ligature tied, the section of the vein completed, and the wound closed by suture. A simpler method is to thrust a sharp needle directly into the vein without preliminary incision. Transfusion is a more difficult operation and one rarely required in medical cases. By means of special cannulas the surgeon connects the bloodvessels of the "donor" with those of the patient. Enteroclysis is discussed on page 144. In most cases it is a very efficient, safe, and painless substitute for the above-mentioned procedures.

Anemia.—Anemia is a deficiency in the quality or quantity of the blood, with a reduction in the number of red cells and in the percentage of hemoglobin (coloring matter). Anemia may be local or general, acute or chronic, primary or secondary. Local anemia is really a circulatory disturbance and has nothing to do with the composition of the blood; we have an example in transitory anemia of the brain causing syncope or "fainting." Acute anemia is generally the result of a profuse hemorrhage, as in injury, accidents of childbirth, gastric ulcer, cirrhosis of the liver, or phthisis. The most important anemias are chronic and either primary or secondary.

The primary anemias are, as far as we know, definite diseases involving blood formation and destruction; the secondary anemias are symptomatic of other conditions and diseases, repeated hemorrhages, internal parasites, acute and chronic infections, poisons, malignant tumors, wasting diseases, etc. Most secondary anemias are like chlorosis and are therefore spoken of as chlorotic. In these cases the red cells are moderately diminished in number but it is the coloring matter which is especially deficient so that even the individual cells, like the patients themselves, are pale. The cells may be very little altered in other respects from the normal. Some of the red ones, while of normal size, may be nucleated (normoblasts). Other secondary anemias resemble the pernicious variety. In this type the red cells are greatly reduced in number, irregular in size, shape, and coloring (when stained), and many of them are nucleated. Although the patient may have an intense pallor the individual cells may be darker than normal. This sort of anemia is observed in "essential" anemia, in the so-called cancerous cachexia, in chronic Bright's disease, etc. The patients do not respond readily to treatment and arsenic is usually of greater use than iron.

Chlorosis.—Chlorosis, or the "green sickness," occurs in young girls and is associated with menstrual disturbances, constipation, improper diet, overwork, and unhygienic conditions. The cheeks may be red in spite of the general pallor and the nutrition may not be markedly affected. The blood changes have been described above. The disease was formerly very prevalent but has practically disappeared in this locality, due no doubt to shorter working hours, improved diet, etc. It is possible also that many cases which we now label incipient tuberculosis, intestinal toxemia, hookworm disease, etc., were formerly called chlorosis.

Treatment.—Treatment consists in proper hygiene and diet, laxatives, and iron, the latter usually in the form of "Blaud's" pills.

Pernicious Anemia.—Essential or pernicious anemia is characterized by a progressively downward course, often with periods of temporary improvement, and a fatal termination. The patients may not lose much weight but become extremely weak and acquire a pale lemon hue. There may be irregular fever. The red blood cells fall to a million or two, or even less, while the coloring matter is reduced to a less degree. The red cells are very irregular in size, shape and coloring, and many of them are stippled (after staining) with blue dots (also seen in lead poisoning). Nucleated red cells (normoblasts), particularly if very large (megaloblasts) or small (microblasts) are suggestive of this form of anemia. In hemorrhagic anemia normoblasts alone are seen.

Sometimes irritation or inflammation of the gums and tongue may be found, or the stomach and intestines may show evidences of complete atrophy. The former may be a cause of the anemia; the latter, like the spinal symptoms which occasionally appear, is doubtless the result of it. Many cases which have been considered pernicious anemia during life have been found at autopsy to be due to latent cancer, Bright's disease, etc.

Treatment.—The treatment is not hopeful, although great temporary improvement often occurs either spontaneously or after the use of iron, bone marrow, and arsenic. The last named is the most valuable remedy and is given by the mouth as Fowler's solution or arsenic trioxide, and hypodermically as sodium cacodylate or atoxyl. Its action should be carefully watched as already mentioned under Chorea.

Splenic Anemia and Polycythemia.—Splenic anemia is a rare disease, characterized by great enlargement of the spleen, anemia, and later by cirrhosis of the liver with ascites. In the latter stage, it is known as Banti's disease. Excision of the spleen is sometimes carried out with benefit to the patient.

In contrast to anemia, there is a group of diseases, mostly rare, characterized by cyanosis (blueness), enlarge-

ment of the spleen, and enormous increase in the number of red cells. This group of symptoms is described as polycythemia. Severe cyanosis of a totally different character is sometimes brought about by acetanilid and similar drugs which have a destructive action on the blood (avoid headache "cures").

Leukemia.—In leukemia there is, sooner or later, a pronounced anemia in addition to an enormous increase in the number of white blood cells. The latter, which normally amount to less than ten thousand per c.mm. may increase in this disease to three hundred thousand or more. The white cells, which under normal conditions, as we have seen, are of several varieties may be present in unusual proportions (*e. g.*, an excess of lymphocytes in lymphatic leukemia), or there may be a large number of abnormal cells (myelocytes in myeloid leukemia). The lymphocytes in leukemia are often unusually large; the myelocytes are large mononuclear cells with granules which stain red, blue, or purple.

Patients with leukemia come to the physician for bleeding from the gums, epistaxis, or other forms of hemorrhage, for a tumor in the abdomen (large spleen), for enlarged glands, or merely for general weakness. In myeloid or splenomyelogenous leukemia, the commoner variety of the disease, there is tremendous enlargement of the spleen; in lymphatic leukemia, the superficial lymphatic glands are enlarged. The diagnosis is made by examination of the blood and if this is neglected, the disease is likely to be overlooked. The course is usually chronic and eventually fatal. Acute lymphatic leukemia is occasionally seen. In a case recently under observation death occurred within a week of admission to the hospital, although the glands were only slightly increased in size.

Treatment.—Treatment consists of rest, good food, attention to the general hygiene, and the administration of arsenic. The *x*-rays are often useful. Temporary improvement as in pernicious anemia is not at all unusual.

Hodgkin's Disease.—Hodgkin's disease (pseudo-leukemia), like leukemia, is characterized by anemia and

enlargement of the lymphatic glands and spleen, but there is no increase in the number of the white cells. The liver is moderately enlarged. The enormous spleens so common



FIG. 12.—Hodgkin's disease. Notice the enormous enlargement of the lymphatic glands of the neck and axillæ. (Hare.)

in leukemia, are not observed. The enlargement of the lymphatic glands, on the other hand, is usually more pronounced than in leukemia and often gives rise to localized pressure. Frequently the glands of the neck

form an enormous collar causing great deformity and venous congestion of the face. At other times the intrathoracic glands are first and predominantly affected, causing pressure on the bronchi, etc., with resulting cough, dyspnea, and cyanosis. Ultimately most of the lymphatic groups become involved. The disease is very chronic and the outcome doubtful. Treatment is along lines similar to those found useful in leukemia. The x-ray treatment is temporarily very efficacious; sometimes glands may be excised with benefit.

Purpura.—Hemorrhage into the skin or mucous membranes is spoken of as purpura. The hemorrhagic patches may be large and diffuse (ecchymoses) or minute and discrete (petechiæ). At first they are purple in color but as they clear up they assume the color of a bruise. Severe types of measles, smallpox, and other infections may be associated with hemorrhagic or purpuric eruptions; in typhus fever and epidemic meningitis petechiæ are a characteristic feature. Certain drugs and poisons such as quinin and belladonna may also cause purpura. Purpura occurs in scurvy, in Bright's disease, in debility, and in old age (slight injuries). Cases in the newborn are marked by bleeding from the umbilicus and by bloody urine.

Rheumatic purpura is closely related to acute articular rheumatism; there is either a history of the latter disease, or a swelling of the joints accompanies the eruption. The purpuric spots are usually confined to the lower extremities; they may be simulated by hemorrhagic dots due to fleas or lice (pediculi). The disease is usually mild with very slight fever, and is treated in the same way as rheumatism.

Purpura hemorrhagica, on the other hand, is a severe disease characterized by extensive hemorrhages into the skin and mucous membranes. Hemorrhages from the nose, stomach, intestines, and bladder show that the affection is not confined to the visible mucous membranes. Although there is, as a rule, no fever or other constitutional

symptoms, nevertheless the hemorrhages continue, and death ensues in a few hours or days. Fortunately the disease is rare.

Hemophilia.—Bleeders are persons who have an hereditary tendency to attacks of severe hemorrhage, either as the result of slight injuries or without obvious cause. The blood is presumably lacking in certain constituents which are necessary to prompt coagulation. This disease which is known as hemophilia is seen in males only, but, curiously enough, is transmitted through the female side, *i. e.*, a bleeder's sons do not suffer from or transmit the disease but his daughters pass it on to their male offspring.

The traditional treatment of hemorrhage consists in absolute rest, sometimes secured by a hypodermic of morphin, and in the administration of astringents and styptics such as gallic and tannic acids. Ergot is used to contract the bloodvessels and nitroglycerin to dilate them as circumstances seem to indicate. At the present time, while we still use these measures, we depend more on the following: packing, syringing with hot water, the application of adrenalin, the internal use of calcium lactate, and the subcutaneous administration of blood serum. After the administration of normal horse serum, as after diphtheria antitoxin, urticaria may develop or, very rarely, severe or even fatal collapse. If the physician cannot be reached immediately a hypodermic of morphin and atropin should be promptly administered.

DISEASES OF THE LYMPHATICS AND LYMPHATIC GLANDS.

General and local enlargement of the lymphatic glands may result from tuberculosis, syphilis, and other infections as well as from mechanical irritants such as coal dust. The last-mentioned irritant often gains access to the bronchial glands from the air passages and from the lungs. Tubercular glands are most often found in the

neck (infection from the tonsils), in the neighborhood of the bronchi, and in the glands of the mesentery (the membranous sling which supports the small intestine). Enlargement of the bronchial glands is usually associated with tuberculosis of the lungs. Occasionally the condition may exist alone and give rise to intractable cough. Tuberculosis of the mesenteric glands occurs in children and causes excessive wasting (*tabes mesenterica*). In syphilis there is a slight general enlargement of the superficial lymphatic glands, particularly significant when it involves the glands at the inner side of the elbow (*epitrochlear*) and at the back of the neck. The lymphatic glands are also enlarged in many other infections, in certain anemias, and in the neighborhood of malignant growths. Frequently the irritation caused by head lice leads to enlargement of the glands at the back of the neck.

DISEASES OF THE DUCTLESS GLANDS.

The spleen, thyroid, thymus, suprarenal capsules, pituitary body, etc., are spoken of as ductless glands, because they have no outlet for their secretions except into the circulation. The spleen has to do with the formation and destruction of the red blood cells, and perhaps with the production of immunity to infection. It is not, however, an organ which is essential to life. The remaining ductless glands as well as the testicles and ovaries which have an internal secretion in addition to their more obvious function, have a regulative influence on growth, nutrition, sexual characters, blood-pressure, etc. Some of the glands seem to have opposing actions, so that if one is overactive or another underactive, pathological symptoms may develop. The suprarenal capsules have to do with the maintenance of blood-pressure. If their influence is removed the pulse becomes soft and small. If the thyroid is overactive the pulse is rapid, full, and soft; if its function is depressed, the pulse is slow and the mental processes dull. The pituitary regulates growth.

If its function is disordered, there is either overgrowth of bones and tissues, leading to gigantism on the one hand, or the retention of the characters of infancy with obesity (infantilism) on the other.



FIG. 13.—Sporadic cretinism, aged twenty-one years. Before treatment. (Dock.)

Simple Goitre.—An undue, persistent enlargement of the thyroid is known as goitre. The slight, temporary enlargement which occurs in many women at the menstrual period is not abnormal. Simple goitre, which occurs endemically in Switzerland and in other mountainous countries, and sporadically in other places, is characterized by an enlargement of the gland which is usually asymmetrical and may reach grotesque propor-

tions. The disease is not usually accompanied by symptoms, except those of local discomfort or of interference with breathing or swallowing. If the growth reaches any great size or produces dangerous pressure symptoms, par-



FIG. 14.—Case of Dr. Hermon Sanderson. After four months' treatment with thyroid extract. (Dock.)

tial but not total excision is advisable. Complete removal will cause the development of symptoms of myxedema on account of the loss of the thyroid secretion.

Myxedema and Cretinism.—Myxedema, whether resulting from removal of the thyroid or from spontaneous atrophy or loss of function of the gland, is characterized, as the name implies, by deposits of so-called mucoid tissue beneath the skin which in some respects resemble

edema. The swelling, however, is firm and does not "pit" on pressure like true edema. These deposits are most often seen above the clavicles. The patient becomes mentally torpid and sleepy, the pulse is slow, the hair brittle, and the skin dry. Myxedema usually occurs in women after middle life. Cretinism, on the other hand, is due to congenital, thyroid insufficiency and manifests its symptoms in childhood, although the patients may survive until adult life. They retain the fat, chubby appearance of infants, largely as a result of extensive deposits of mucoid tissue. The tongue is large and lolls out of the mouth and a high degree of idiocy is present. If they learn to walk they only do so imperfectly.

Treatment.—The treatment of myxedema and cretinism by thyroid extract has been one of the triumphs of modern therapeutics. If the extract is administered to cretins, mental improvement occurs in a short time with restoration of normal development and growth. Excellent, although less striking results are obtained in myxedema by the aid of the same remedy. Iodin and the iodides are usually beneficial in simple goitre and myxedema. It is an interesting fact that the thyroid itself contains an unusual proportion of iodine.

Exophthalmic Goitre. — Exophthalmic goitre, or Graves' disease is apparently due to, or associated with, oversecretion of the thyroid. The pulse is rapid, the mind alert and overactive, and all the vital processes stimulated, so that the patient tends to lose weight and strength instead of accumulating deposits of fat, as in the last-named conditions. The thyroid is only moderately enlarged, and is frequently symmetrical. The chief diagnostic signs of exophthalmic goitre are: (1) prominence of the eyeballs and widening of the aperture between the eyelids, so that when the patient looks downward, the white of the eye is seen above the iris; (2) a "fine," rapid tremor of the hands; (3) moderate enlargement of the thyroid gland; (4) rapidity of the pulse. The symptoms may come on acutely but are usually

subacute or chronic. In addition to the so-called cardinal symptoms the patient may exhibit general nervousness, loss of strength, attacks of indigestion, diarrhea, etc.



FIG. 15.—Exophthalmic goitre. (Doek.)

Treatment.—Medical treatment is unsatisfactory in the above-described condition, because we have no specific drug, and the only method of limiting the oversecretion is by removing part of the gland by operation, or by limiting the blood supply by tying one or more of the bloodvessels which enter it. Medical treatment is some-

times successful and almost always helpful. It consists essentially in partial or complete rest. If the symptoms are at all active the patient should be confined to bed for a number of weeks, until the cardiac irritability has disappeared. He should also be shielded from anything which might cause worry or excite attacks of tachycardia (rapid pulse). Surgeons are so mindful of this fact that they frequently do not allow their patients to know when operation is intended. The patient may be given a whiff of ether repeatedly on successive days before it is considered opportune to push anesthesia to a degree sufficient for operation. Sodium phosphate is used to secure regular movement of the bowels and may have some other therapeutic value. Drugs which retard the pulse, such as digitalis, are not of much use. An ice-bag over the precordium is usually more effective. Iodides and iodine preparations are usually contra-indicated, but in some mixed cases they may be of benefit.

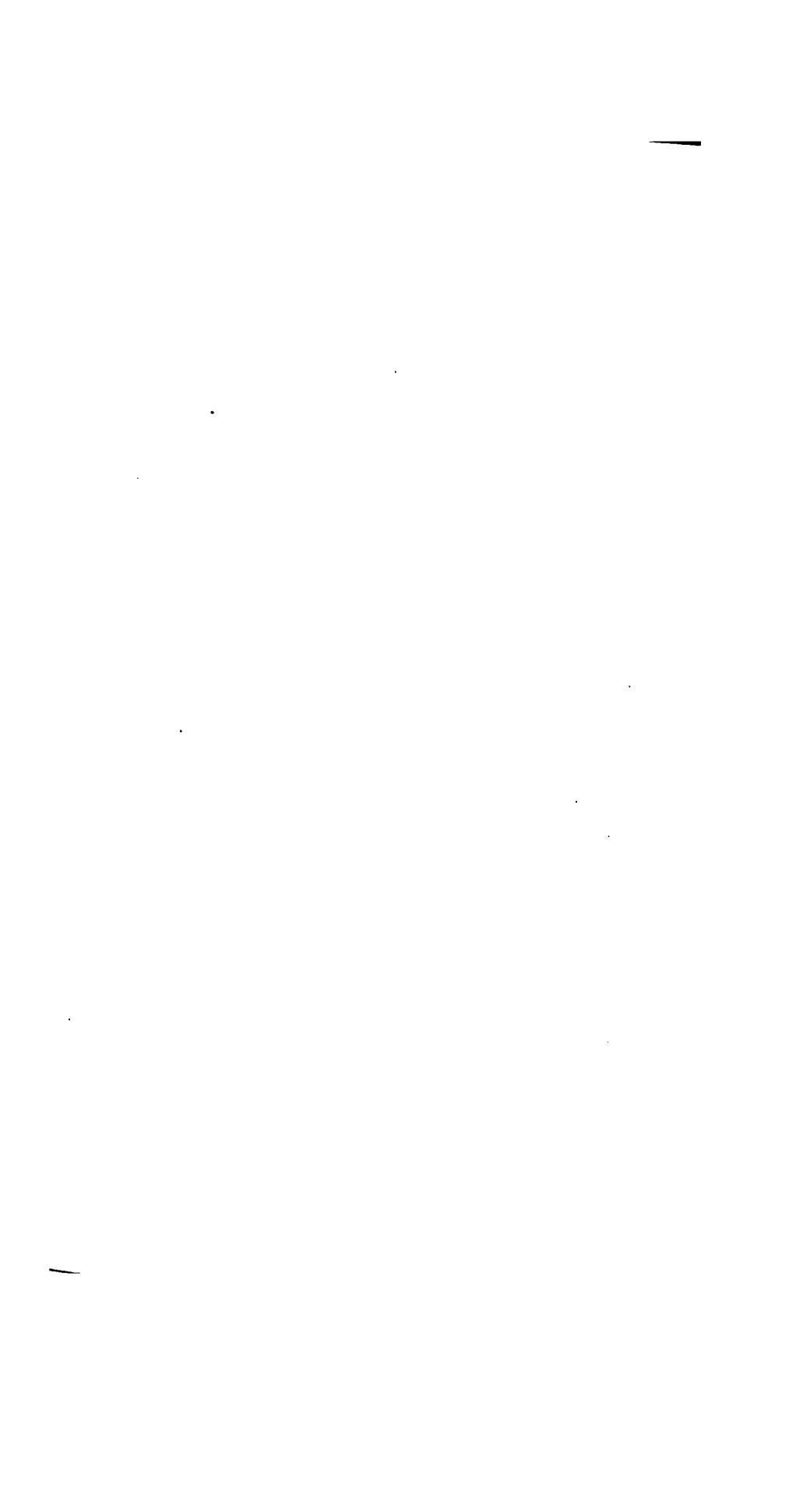
Thymic Asthma and Thymus Death.—Diseases of the thymus are rare, and can receive only a passing notice. This gland, situated beneath the upper part of the sternum is larger during childhood, but with the beginning of adult life it wastes away and practically disappears. Children in whom the thymus is enlarged may suffer from symptoms of obstruction, due to pressure of the enlarged gland on the air passages—*thymic asthma*. At other times, there may be no asthma but the subjects of the enlargement are liable to sudden death from the most trivial causes—*thymus death*. Apparently healthy children may die after a few whiffs of chloroform or in the midst of a simple operation, such as that for adenoids.

Addison's Disease.—Addison's disease is due to deficient secretion of the adrenal glands and may result from tubercular infiltration, tumors, etc. The symptoms are pronounced pigmentation of the skin and mucous membranes, excessive weakness, and soft pulse. The patients almost invariably die of cardiac failure. This disease is extremely rare. I performed an autopsy in one case

(tubercular), and have seen but one or two others during a period of more than fifteen years.

Infantilism and Acromegaly.—Diseases of the pituitary body in pronounced forms are rare. Mild disturbances of the pituitary are probably responsible for many cases of obesity, particularly when these are associated with faulty development of the sexual characters, as in "infantilism." Diseases of the pituitary are at present attracting a great deal of attention, perhaps out of due proportion to their frequency and importance.

Acromegaly is the most definite disease produced by the enlargement and overaction of the pituitary gland. It is characterized by progressive enlargement of the bones, particularly of the face, hands, and feet. The features become so large and gross that the patient resembles a gorilla, while the fingers and toes appear like sausages. The hands are thought to resemble spades because of their square form. On account of the enlargement of the gland, the patient may also suffer from symptoms of brain tumor, particularly headache. Until recently there was no treatment. At the present time surgery is a possible recourse in some cases.



PART III.

DISEASES OF THE CIRCULATORY SYSTEM.

CHAPTER I.

DISEASES OF THE BLOODVESSELS AND PERICARDIUM.

GENERAL SYMPTOMATOLOGY.

Pulse.
Blood-pressure.
Pulse Tracings.
Syncope.
Dyspnea.
Dropsy.
Cyanosis.
Pulsations.
Capillary Pulse.
Thrills.

Murmurs.
Heart Area.

DISEASES OF BLOODVESSELS.

Arteriosclerosis.
Aneurysm.
Embolism.
Thrombosis.
Infarction.

PERICARDITIS.

Hydropericardium.

General Symptomatology.—The Pulse.—The pulse was formerly the most important index of a patient's condition which was available to the physician, and although it has fallen from its high estate it still yields important information, especially when interpreted by modern instrumental methods. The accurate observation and recording of the pulse rate and rhythm is one of the most important duties of the nurse. In taking the pulse certain characteristics, most of which are within the scope of the nurse, are to be noted: (1) the rate; (2) the size; (3) the celerity; (4) the tension; (5) the rhythm; and (6) the condition of the vessel wall.

The normal adult pulse rate ranges between 65 and 80, varying with the individual and the position, whether reclining, sitting, or standing. It is markedly affected by exercise, and in nervous persons and children, by excitement. In keeping records, care should be employed to take the pulse under uniform conditions; the best time to take a baby's pulse is during sleep. In infancy the pulse rate varies from 140 at birth, to 100 at two or three years, after which it gradually declines, reaching the adult rate at about the time of puberty. In fever the pulse rate ordinarily increases in proportion to the temperature; in uncomplicated typhoid the pulse is relatively infrequent, in scarlet fever it is relatively rapid.

A persistently rapid pulse rate is designated as tachycardia. Paroxysmal tachycardia is a nervous affection of the heart characterized by periods of extremely rapid pulse. Tachycardia may or may not be accompanied by the sense of palpitation. A persistently slow pulse is spoken of as bradycardia. In some individuals the normal pulse rate may be 40 or less. Fatty heart, jaundice and meningitis are widely differing conditions which are characterized by an infrequent pulse rate.

The pulse is spoken of as large or small, depending on the apparent size of the pulse wave as estimated by the palpating fingers. To estimate the celerity of the pulse, attention is directed to the way in which the pulse wave strikes the fingers. If it strikes quickly and recedes rapidly the pulse is spoken of as "quick." If the pulse wave appears to reach its maximum gradually and in the same fashion recedes, the pulse is technically described as "slow." In this sense "slow" has nothing to do with pulse rate. The "Corrigan" pulse, as seen in insufficiency of the aortic valves, is at the same time a "large" or full pulse, and a "quick" pulse. In aortic narrowing (stenosis) the pulse is "small" and "slow."

The force or tension of the pulse may be estimated by the amount of pressure required to obliterate the pulse

wave; this may require one, two, or three fingers. The method is crude and has now been largely supplanted by instrumental methods (see below). If the tension is high the pulse is described as "hard," for example, the small, hard ("wiry") pulse of peritonitis; if low, as "soft." The dicrotic pulse of typhoid fever is one of extremely low tension giving the deceptive sensation of a double impulse.

The rhythm of the pulse is another quality which we detect imperfectly by the finger but more accurately by simultaneous tracings (see below) from the radial artery (or heart) and from one of the large veins of the neck. The following are the arrhythmias which most commonly come under the observation of the nurse. In many young persons with low tension the pulse becomes more rapid during inspiration; this is not of serious importance. Another variety of common occurrence is the partially irregular pulse in which a beat appears to be dropped at more or less regular intervals without interfering with the general regularity of the pulse. Pulse tracings have shown that, as a matter of fact, an extra beat ("extrasystole") is thrown in ahead of time, taking the place of the regular beat which falls out. The long pause before the next regular beat gives the impression of a lost wave. This form of arrhythmia is common in middle-aged and elderly persons, and often is of no serious significance, although it may be a sign of myocarditis. Complete irregularity or total arrhythmia is found in failing heart (cardiac insufficiency), and is usually of serious significance. After the use of digitalis in large doses, and in some cardiac conditions, strong beats may alternate regularly with weak; at other times beats occur in pairs, triplets, etc.

The condition of the arterial wall should properly be determined at the beginning of the examination, for if the arteries are sclerotic (hardened), or calcareous ("pipe stem"), much allowance must be made in estimating the qualities of the pulse.

The Blood-pressure.—The blood-pressure is principally dependent on the force of the heart and the resistance in the bloodvessels. The latter varies with the state of dilatation or contraction of the arteries; thus, during digestion the abdominal vessels are dilated, while during exercise, more blood flows to the muscles. In any one individual these factors compensate for each other, so that the pressure remains fairly constant. After severe hemorrhage the volume of the blood may be reduced to such a degree as to diminish the blood-pressure. The

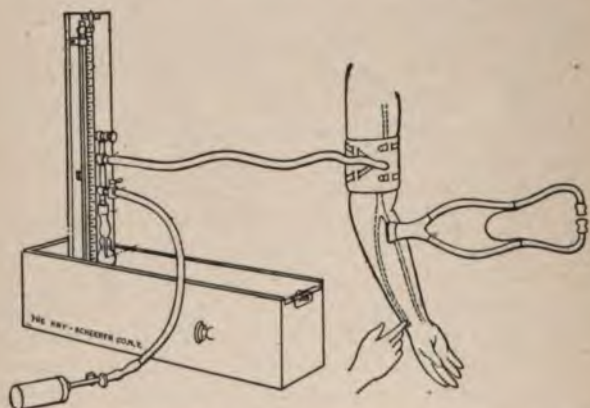


FIG. 16.—Determination of blood-pressure by auscultation, or by palpation of the radial pulse. (Musser.)

pressure in the artery varies constantly with the alternating contraction and relaxation of the heart; with the pulse, or systole, the pressure increases; with the interval, or diastole, it diminishes.

The systolic blood-pressure is measured by determining the force required to shut off the pulse completely. The instrument which is used for the purpose is styled a sphygmomanometer or blood-pressure instrument. It consists of a hollow rubber cuff connected by tubing with a pump and a column of mercury graduated in millimeters

(manometer). The cuff is placed about the upper arm and the measure raised by means of the pump, until the pulse disappears at the wrist. The pressure is then gradually lowered until the pulse reappears at the wrist, or better, until a rhythmic tap is heard in the artery at the bend of the elbow. At this point the height of the mercury in millimeters is noted and recorded. Nurses, if called upon to make the examination, may determine the systolic pressure (which is the more important) by using the pulse, with which they are familiar, as an indicator. In normal young adults the systolic blood-pressure is usually about 120 mm., and the diastolic, 75 to 85 mm. In older persons the systolic pressure is somewhat higher. Under pathological conditions the blood-pressure shows great variations. In nephritis, *e. g.*, the systolic pressure frequently exceeds 200 mm.

Pulse Tracings.—The sphygmograph is an instrument which makes graphic tracings of the pulse, usually on smoked paper, recording the variations and irregularities, so that they may be subsequently studied. The modern instruments (polygraphs) not only record the pulse at the wrist but also the heart beat and the pulsation of the veins in the neck. Tracings are often of great value to the physician in the diagnosis and prognosis of doubtful cases. In heart-block, for instance, the upper part of the heart (auricle) may be found—by tracings taken from the veins—to be pulsating at a different and more rapid rate than the lower (ventricle)—as shown by tracings from the apex of the heart. This symptom is characteristic of the rare Stokes-Adams disease, in which bradycardia, attacks of syncope, and convulsions occur.

Syncope.—Syncope or fainting is a circulatory symptom due to anemia of the brain and is frequently brought about by nervous influences (excitement, fright, pain), defective local blood supply (disease of heart or bloodvessels), and acute anemia (hemorrhage). In itself it is not serious and is readily relieved by the horizontal position, fresh air, and diffusible stimulants (whisky, aromatic spirits of

ammonia or Hoffman's anodyne). In hemorrhage or in cardiac disease it may be of serious moment.

Dyspnea.—Cardiac dyspnea (see Part III, Chapter II) is aggravated by exertion and, as a rule, relieved by rest. Distressing nocturnal dyspnea with precordial pain, particularly in aortic disease, sometimes compels the patient to sit up in bed (orthopnea). Cheyne-Stokes respiration was originally described in connection with disease of the heart muscle, but is more characteristic of nephritis.

Dropsy.—Cardiac dropsy typically begins in the feet and extends upward, successively involving the legs, thighs, genitals, body, etc. The pleural, pericardial and abdominal cavities are often filled with fluid (hydrothorax, hydropericardium, and ascites). The dropsy of liver disease begins with ascites and that of nephritis with edema of the eyelids and subcutaneous tissues without reference to gravity. It is not rare, however, for cardiac effusion to begin with ascites or hydrothorax.

Cyanosis.—Cyanosis or blueness is common in heart disease though not at all unusual in diseases of the lungs, blood, etc. It is most intense in congenital heart disease in which the cyanosis may be continuous, without any immediate risk of death. In dilatation of the heart an equal degree of cyanosis may rarely be observed, but if it is not promptly relieved by bleeding or other treatment, death usually ensues in a short time. In the ordinary cardiac case the hue is dusky, rather than distinctly blue. Very marked cyanosis occurs after certain poisons, for example after the prolonged use of acetanilid and other coal-tar products. The cyanosis of pulmonary disease is seen in pneumonia, emphysema, etc., as well as in obstructive disease of the larynx (diphtheria).

Pulsations.—Closely connected with cyanosis is venous repletion (fulness) and venous pulsation. The former is most frequently observed in the neck and is suggestive of cardiac insufficiency, respiratory distress, or pressure by tumors, etc., within the chest. The latter is a cir-

culatory phenomenon not always to be distinguished by inexpert observers from pulsation of the arteries (carotids) which is often very prominent in nervous persons and in cases of aortic insufficiency. Cardiac pulsation is normally seen at the apex and abnormally over a wider area. In aneurysm the pulsation is outside the limits of the normal heart area.

Capillary Pulse.—The capillary pulse is seen in aortic insufficiency, less often in normal persons. If the forehead is rubbed until reddened or the finger-nail pressed until slightly blanched, a faint blush will be noticed with each pulsation of the heart.

Thrills and Murmurs.—Thrills are vibratory sensations felt over the heart or bloodvessels; they are diagnostic in mitral stenosis. Murmurs are abnormal sounds of the heart and are of value to the physician in the diagnosis of valvular lesions. In pericarditis the murmur is designated as a friction or rub.

Heart Area.—The size and position of the heart are determined by percussion (dulness), palpation (pulsation), or by the x-rays.

DISEASES OF THE BLOODVESSELS.

Arteriosclerosis.—Thickening or "hardening" of the arteries is known as arteriosclerosis. As the minute capillaries are also involved, the condition is sometimes called arteriocapillary fibrosis. Thickening of the veins (phlebosclerosis) is not so common, or, to casual examination, so evident. In arteriosclerosis the vessel wall may be thickened and leathery, or little bony plates like beads may be felt in the artery. The affected vessels are elongated and tortuous ("snake like") so that they appear too long for their beds; this tortuosity is easily seen in the temporal, and felt in the brachial arteries. On the inner surface of the aorta and other large arteries, yellowish patches which eventually become bony plates are fre-

quently observed at autopsy. This condition is known as atheroma.

Arteriosclerosis is a natural condition in old age, but the time of onset is much affected by heredity, mode of life, and disease. I have seen it less marked in a woman of a hundred years than in a fifteen-year-old boy of bad heredity. An advanced degree of sclerosis is common at middle age in laborers, while in those of sedentary habit, if they have avoided excess, it may be postponed for several decades. Arteriosclerosis is also induced by toxemia and strain. Toxemia may be due to acute or chronic infections, above all to syphilis, to external poisons, such as lead and mercury, and to the metabolic poisons of gout, or nephritis. Excess in food and drink (alcohol¹) is distinctly harmful. Strain may be mental (worry) or physical (excessively heavy labor).

Arteriosclerosis is associated as a rule with high blood-pressure, enlargement of the heart, and signs of involvement of many organs. In the variety present in old age, the blood-pressure is normal. Since the arteries and capillaries reach all organs and tissues, some or all of the latter are involved in the disease. Occasionally one organ will be especially "hard hit." If the blood-pressure is high, the heart dilates and eventually becomes insufficient. Under these circumstances shortness of breath, dropsy, and effusion of fluid into the large cavities occur, a condition which is difficult to distinguish from that of primary cardiac disease. The urine almost always shows a little albumin and a few casts, and frequently the symptoms of nephritis dominate the case; other types are associated with apoplexy, aneurysm, or excessive involvement of the peripheral arteries, causing intermittent lameness (claudication) or gangrene.

Treatment.—The advance of the disease may best be checked and its bad effects minimized by a quiet, regular life with moderation in exercise, food, and drink. Worry

¹ Some authorities deny the injurious effect of alcohol in this condition.

and mental strain are deleterious. The action of the skin should be favored by warm baths, the secretion of urine should be kept up by the free use of water except in cases of high blood-pressure, and constipation should be avoided. In recent years great stress has been laid on the use of buttermilk and other beverages containing lactic acid and lactic acid bacilli. These are supposed by their advocates to diminish fermentation and putrefaction in the intestines, and to prevent the formation and absorption of injurious poisons. The diet should contain only a moder-

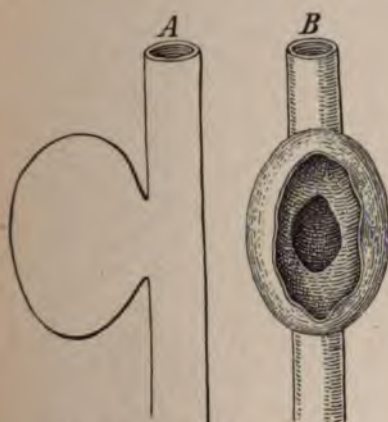


FIG. 17.—Saccular aneurysm.
(Ashhurst.)



FIG. 18.—Fusiform aneurysm. (Ashhurst.)

ate amount of meat and should be free from cabbage and other coarse vegetables which often cause excessive flatulence in arteriosclerotic patients. Milk and eggs, cereals, and green vegetables may be used freely.

Potassium iodide, in small doses, apparently has a favorable influence on the course of the disease. Other specific medicaments have been suggested but are seldom employed.

Aneurysm.—An aneurysm is a localized dilatation of an artery. This may be symmetrical, involving the whole

circumference, when it is spoken of either as a fusiform (spindle-shaped) or a cylindrical aneurysm; or it may project from one side of the vessel, when it is styled a sacculated aneurysm. Aneurysms may develop in any artery however minute; such minute aneurysms are the common cause of cerebral hemorrhage. Aneurysms of the peripheral arteries, for example of the popliteal at the back of the knee, are discussed in books on surgery.

In medicine we are principally concerned with aneurysms of the aorta and its primary branches. Aneurysms are most commonly observed at the beginning of the aorta as it arches up from the heart, in the transverse part of the arch of the aorta, and again as it descends near the spine through the thorax and abdomen. As will be seen later the symptoms vary greatly with the situation of the tumor. The causes of aneurysm are in general those of arteriosclerosis. Age is less of a factor, and excessive strain and syphilis are of chief importance. Evidence of the latter disease is found in a vast majority of cases (Wassermann reaction, *vide* syphilis). The patients, as a rule, are males under fifty and often negroes.

Symptoms.—The symptoms of aneurysm *per se* are those of pulsating tumor. This is expansile when accessible to palpation, as in the abdomen. In the chest the ribs or interspaces may be seen to heave and an abnormal area of dulness may be found on percussion. If the hand is laid on the aneurysmal tumor, a vibratory sensation or thrill is appreciated. Dilatation of the artery in itself occasions more or less pain, but the severe pain of aneurysm is principally due to pressure upon, and erosion of, surrounding structures. If the aneurysm is progressive the wall will finally become so attenuated that oozing of blood occurs, or sudden rupture with dangerous or fatal hemorrhage.

Most of the symptoms and signs of aneurysm are attributable to pressure or dragging upon surrounding structures. In aneurysm at the beginning of the aorta, the ribs and chest wall may be gradually eroded or per-

forated. In the thorax and abdomen the aneurysm may erode the spinal column, causing intense boring pain and finally paralysis of the lower extremities. Pressure or traction on the larynx, trachea, or bronchi may cause difficulty in breathing, tracheal tug, loss of voice or cough. Tracheal tug is a rhythmic movement transmitted to the larynx by the aneurysm dragging on the trachea. Pressure on the nerves of the larynx causes spasm or paralysis of laryngeal muscles and often lends a "brassy" character to the cough. Pressure on the bloodvessels causes dilatation of the veins of the neck and inequality of the pulses. Pressure on the gullet interferes with swallowing. Still another symptom, due to pressure on the nerves, is inequality of the pupils. Aneurysm may perforate into the air passages, the pleura, the gullet, and other structures as well as externally. In any case the resulting hemorrhage is likely to prove fatal.

Treatment.—The object of treatment in aneurysm is to stay the progress of the disease, to promote clotting and consolidation in the sacculated variety, and to relieve symptoms. If the disease is progressing, and the pain severe, absolute rest with the use of the bed-pan, etc., is required. If an attempt is to be made to cure the aneurysm, a dry diet, containing not over eight ounces of fluid, may be instituted and kept up for a long period of time. The class of patients ordinarily attacked by aneurysm will rarely submit to such privation, as no definite promise of cure can be given. Clotting may also be brought about by introducing many yards of fine gold wire through a hollow insulated needle into the aneurysmal sac. Before the needle is withdrawn an electric current is sent through the wire to hasten the process of clotting. Opinions are divided as to the desirability of this operation. Potassium iodide is a favorite remedy in aneurysm as in arteriosclerosis. Morphin is often required to relieve pain or to calm excitement in threatened hemorrhage. Occasionally slow bleeding occurs, but in the majority of cases the hemorrhage is

sudden and rapidly fatal, and therefore not susceptible to treatment.

Embolism, Thrombosis, and Infarction.—As the arteries pass to their distribution, they divide and subdivide, so that, if we select a small artery, we shall find that its



FIG. 19.—An infarct of the kidney. An embolus lodging in the artery (a) has caused infarction in the shaded area. There is a surrounding zone of congestion. (Orth.)

area of ultimate distribution is cone-shaped, and may be compared to the trunk and branches of an elm tree. Usually there is more or less communication between neighboring areas, but this is not invariable (brain). If a small fragment of fibrin ("vegetation"), or a minute clot plugs one of these small arteries, clotting or throm-

bosis occurs in the branches beyond, and the whole area may lose its vitality. These triangular or cone-shaped areas are known as infarcts and occur in the kidneys, spleen, brain, lungs, etc., in diseases such as endocarditis, phlebitis, and pyemia. They may be pale or red, depending on the richness of the neighboring blood supply. In the brain, infarction is followed by softening; elsewhere it is often accompanied by hemorrhage and terminates either in scar formation, or, if there is infection, in abscess. Infarction may result from thrombosis without preceding embolism. Infarction of the lung causes sudden pain, hemorrhage, and symptoms of consolidation. In the kidney and spleen it may occasion pain, and in the former, bloody urine. Embolism of the mesenteric vessels, supplying the small intestine, causes pain, bloody stools, obstruction, gangrene, and peritonitis.

Thrombosis may also occur in the veins as the result of inflammatory change in the vessel wall (phlebitis), pressure, or any cause leading to slowing of the current or increasing the coagulability of the blood. Thrombosis in a vein interferes with the return circulation, and if a large vessel is involved causes edema, cyanosis, and venous repletion. After a time adequate circulation is usually reestablished by collateral branches (anastomoses). The thrombus may be absorbed or converted into a fibrous mass. The femoral (left) and subclavian veins are commonly affected; less often internal veins, such as the pulmonary vein and vena cava, etc. Femoral thrombosis is common in infections, *e. g.*, typhoid and pneumonia. Thrombosis of internal veins, if of any size, is usually fatal.

PERICARDITIS.

Pericarditis is a term applied to inflammation of the enveloping membrane of the heart. The pericardium is a serous membrane similar to that lining the pleural, peritoneal, and joint cavities. It covers the body of the heart (visceral pericardium) and is reflected from the

great vessels at the base to form a hollow sack (parietal pericardium) enclosing that organ. Pericarditis is of three general types: (1) Fibrinous pericarditis in which the adjoining surfaces of the membrane are covered by a soft, sticky exudate. If the layers are separated the exudate is rough like pieces of bread and butter which have been



FIG. 20.—Fibrinous pericarditis (hairy heart). (Adami.)

laid together and then drawn apart. (2) Pericarditis with effusion in which a greater or less amount (200 to 2000 c.c.) of fluid is thrown out, either clear, purulent, or bloody. (3) As a sequel to either of the above forms, the pericardial layers may become adherent, partially or completely, and in severe cases adhesions may also form between the pericardium and the anterior and posterior chest walls, greatly restricting the movements of the heart.

Pericarditis seldom arises independently but is usually secondary to other diseases, principally infections. The milder cases are due to rheumatism. The condition may produce no symptoms, but is discovered when the heart is examined, as it always should be in rheumatism, for evidence of endocarditis. Children develop these complications in the mildest joint cases, too often dismissed as growing pains. Other acute infections may give rise to pericarditis; of these the most important is pneumonia. This variety is often purulent and is likely to prove fatal. Pericarditis occurs as a complication in many chronic disorders, such as Bright's disease and diabetes. It is due to the particular infection which terminates life and is seldom recognized. Chronic pericarditis with effusion or adhesions is frequently tuberculous. Sometimes the pericardium, pleura, and peritoneum are involved at the same time.

Symptoms.—The symptoms of fibrinous pericarditis may be of the slightest; pain, though present, is not so severe as in pleurisy, and the fever is seldom high. The to-and-fro scratching murmur or rub is very characteristic. With effusion, particularly if purulent, there is pain, oppression, insomnia, restlessness, delirium, etc. The heart dulness is increased and in children the chest may bulge. When the pericardium becomes adherent, symptoms may be absent, but if the heart is bound down to surrounding structures, it works against great obstacles, so that in time it becomes greatly hypertrophied and dilated. Finally, symptoms of cardiac insufficiency ensue. The interspaces between the ribs near the apex and in the back are sometimes drawn in with each contraction of the heart. This is due to adhesions to the diaphragm, etc.

Treatment.—The treatment of acute pericarditis demands absolute rest, the use of the bed-pan, and the administration of food by the nurse. The diet should be similar to that used in fevers. The physician sometimes restricts the amount of fluid in the hope of limiting effusion. The nutritive value of milk may be increased

by the addition of cream, sugars, and cereals. Pain or overaction of the heart may be relieved by an ice-bag which should be applied intermittently. A piece of flannel should be placed between the bag and the chest, and the bag should be supported from a cradle. Hot applications, blisters, and leeches are also used. If the pericarditis is of rheumatic origin the free use of salicylates is of great importance as a curative measure, otherwise medicinal treatment is limited to mild laxatives and to cardiac stimulants and sedatives as circumstances may require. In effusion, if the quantity of fluid is sufficient to cause shortness of breath, oppression, and cyanosis, or if the exudate becomes purulent, the fluid should be withdrawn by paracentesis. The technic of this operation is similar to that employed in tapping the chest. The treatment of adhesive pericarditis is the treatment of cardiac insufficiency; operation is sometimes undertaken for the relief of adhesions (rare).

Hydropericardium.—Effusion of fluid, non-inflammatory in character, into the pericardial sac, occurs in heart, kidney, and liver diseases. If excessive in amount, paracentesis is required.

CHAPTER II.

DISEASES OF THE HEART.

ANGINA PECTORIS AND PRECORDIAL PAIN.
HYPERTROPHY AND DILATATION.
CARDIAC INSUFFICIENCY.
MYOCARDITIS.
VALVULAR HEART DISEASE.
Acute Endocarditis.

Chronic Endocarditis.
Individual Valve Lesions.
TREATMENT OF ACUTE ENDO- AND MYOCARDITIS.
TREATMENT OF CARDIAC INSUFFICIENCY.

Angina Pectoris and Precordial Pain.—Angina pectoris in its typical form is characterized by intense pain over the heart and down the inner side of the left arm, by a sense of constriction in the chest, and by a fear of impending death. In the painful area there is usually hyperalgesia (if the skin or muscles are pinched they are unusually sensitive). The attacks come on suddenly and are of brief duration but they may be frequently repeated. They are sometimes followed by free eructation of gas. Similar but less intense attacks of pain are common in young persons of the neurotic type; they are sometimes called pseudo-angina. Attacks of angina may be induced by an exciting cause which throws additional work on the heart, for example, worry, anger, physical exertion, tobacco, and excessive eating or drinking. True angina is generally believed to be due to atheroma of the coronary arteries (the vessels which supply the heart muscle itself), obstructing their lumen. This induces an acute anemia of the heart muscle and a cramp-like pain which is analogous to that experienced in the legs by elderly persons with arteriosclerosis. Some authorities believe that angina is due, in addition, to any disease involving extreme exhaustion of the heart muscle,

large. Hypertrophy in itself is a useful condition, indicating that the heart is successfully meeting the demands placed upon it while dilatation is an evidence of failure in the same respects. Hypertrophy may affect one or all of the cavities of the heart, and in the case of the left ventricle is characterized by enlargement of the dulness to the left, displacement of the apex in the same direction, and a powerful heaving impulse. The pulse is full and strong and often of high tension. In dilatation the heart is also enlarged, but the apex impulse is indistinctly felt as a feeble tap. The heart sounds are faint (clicking), and the pulse is of a correspondingly poor quality.

Cardiac Insufficiency.—Symptoms.—The symptoms of cardiac insufficiency are more or less similar in all forms of heart disease, and may therefore be enumerated at the beginning. The modifications peculiar to particular lesions will be mentioned later. The symptoms are as follows: breathlessness, sometimes amounting to orthopnea, cyanosis, precordial distress, dropsy, dyspeptic symptoms, enlargement of the liver, edema of the lungs, and scanty urine. The dropsy begins in the dependent parts, for example the ankles when the patient is on his feet, and extends upward. It may become so extreme that the skin, distended to the bursting point, will require puncture. The enlargement of the liver is due to "passive" congestion. The heart is unable, so to speak, to "forward" the blood as fast as it is received from the great veins (the inferior vena cava receives the blood from the liver and portal system) so that the liver becomes enlarged to accommodate it, acting as a temporary "storehouse." Congestion of the liver is often accompanied by slight jaundice and ascites (effusion into the peritoneum). The passive congestion of the lungs leads to edema and frequently to effusion into the pleural cavities, particularly the right. The edema is detected by the occurrence of fine rales at the base of the lungs. The intense congestion of the kidneys causes not only scanty urine, but the presence of albumin and casts.

Causation of Heart Disease.—The causes of heart disease are legion, but Dr. Cabot has recently shown that four—rheumatism, syphilis, arteriosclerosis and nephritis—are responsible for more than 90 per cent. of the cases. Other infections and intoxications (goitre) and congenital disease account for a small number of cases. Congenital diseases include malformations due to faulty development and intra-uterine infections. The latter, unlike those of adult life, affect the valves on the right side of the heart, the pulmonary, and less often the tricuspid valve. Acute articular rheumatism, with the associated conditions, tonsillitis and chorea, is by far the commonest cause of heart disease, particularly in the young. Both heart muscle and valves are damaged ("carditis"), but the permanent changes are principally apparent in the latter (chronic endocarditis). The mitral valves are most frequently attacked. Syphilis is principally operative in adults, and particularly in males. It injures both the myocardium (muscle) and endocardium and is particularly prone to attack the aortic valves. Arteriosclerosis and nephritis account for the largest number of cardiac cases in middle and advanced age. Nephritis induces increased blood-pressure, arteriosclerosis, and hypertrophy of the left ventricle of the heart. If the heart fails under the strain all the symptoms of cardiac insufficiency ensue, and it is often impossible to name the primary lesion. In arteriosclerosis there is either coincident sclerotic change in the heart muscle, with stiffening and shrinking of the valves, or the changes in the arteries and kidneys initiate the disease and are followed by the same train of symptoms described for nephritis.

Myocarditis.—Acute or chronic degenerative and sclerotic affections of the heart muscle are grouped rather loosely under the term myocarditis. Acute degeneration of the heart muscle accompanies all the more serious infections, *e. g.*, typhoid fever and diphtheria. If the patient survives the convalescent period few permanent evidences of the affection may persist. Occasionally

sclerotic or scar-like areas betray the preëxisting disease. Arteriosclerosis is accompanied by sclerotic changes of the heart muscle which diminish the contractile power of the organ. In the obese the heart is frequently burdened by heavy deposits of fat while in wasting disease and severe anemias the muscle itself may undergo fatty degeneration. The symptoms of myocarditis are very variable and indefinite; there may be repeated attacks of cardiac insufficiency as already described; in other cases there may be anginal symptoms; or there may be simple arrhythmia with slight dyspnea, precordial distress, or dyspeptic symptoms. In fatty heart sudden death is not uncommon.

VALVULAR HEART DISEASE.

Acute Endocarditis.—Simple endocarditis begins acutely but insidiously, usually in the course of acute articular rheumatism of which it forms an integral part rather than a complication. At this period it is often overlooked, as there may be no symptoms other than those of the joint infection itself. Sometimes there may be a slight chill, an access of fever, or nocturnal delirium, but the diagnosis will depend upon careful routine examinations of the heart for altered sounds or murmurs. Subsequently, enlargement of the heart will confirm the diagnosis. If rest at this period is prolonged, perfect compensation may be secured and no further symptoms will be observed. Very often, however, the patient gets up too soon, hypertrophy is insufficient, and symptoms become manifest, *e. g.*, dyspnea and slight edema. Cases of simple endocarditis are very prone to subsequent attacks with increased damage to the valves and with general febrile symptoms. Repeated failures of compensation are also common, with or without fresh endocarditis. The symptoms of loss of compensation are those of cardiac insufficiency.

At the opposite extreme is the so-called malignant

endocarditis. This is due to more virulent microorganisms and is accompanied by very irregular temperature of the septic type, severe chills, and drenching sweats. The temperature may range in a single day from 97° to 105° or 106° . The pulse and respiration are extremely rapid.

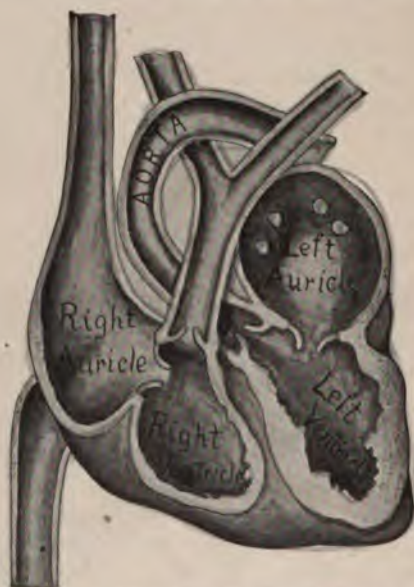


FIG. 21.—Diagram modified from Page to show the relation of the various valves. The tricuspid valves lie between the right auricle and right ventricle; the pulmonic, between the right ventricle and the pulmonary artery; the mitral, between the left auricle and left ventricle; the aortic, between the left ventricle and aorta. If the valves do not close accurately, leakage occurs (valvular insufficiency); if the orifices are narrowed (stenosed) the blood flow is obstructed. (Hare.)

There may be distinct murmurs, but sometimes the action of the heart is so tumultuous, or the respiration so noisy, that nothing can be discovered by physical examination. Examination of the blood reveals a leukocytosis and cultures from the same fluid will often discover the

causative organism (gonococcus, streptococcus, etc.). These cases after a stormy course of a few weeks terminate fatally. Intermediate varieties are much more common than the latter extreme. If an autopsy is performed on a case of simple endocarditis little wart-like vegetations are found on the affected valves, while in the malignant variety the vegetations are larger and are accompanied by ulceration, hence the contrasting terms, warty (verru-cose) and ulcerative endocarditis.

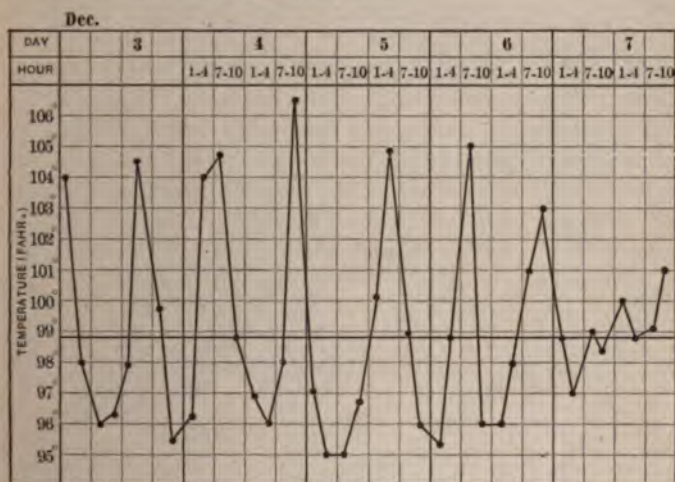


FIG. 22.—Malignant endocarditis (Episcopal Hospital).

Chronic Endocarditis.—The mode of onset of chronic rheumatic endocarditis has already been sketched. The varieties due to syphilis, arteriosclerosis, etc., are chronic from the beginning and are first revealed when the shrinking and distortion of the valves have interfered with the action of the heart and have brought on symptoms of cardiac distress (pain and dyspnea) or cardiac insufficiency. Patients suffering from chronic endocarditis improve on rest and treatment but grow worse when the heart is subjected to strain beyond its capabilities. We

frequently see convalescents who are perfectly comfortable as long as they remain in the hospital wards, but relapse as soon as they are subjected to home conditions, with hard work, stair climbing, and improper diet. Others have so narrow a margin that they are only well, to speak paradoxically, as long as they are sick in bed.

The Individual Valve Lesions.—Disease of the heart valves interferes with their function, either by causing them to become roughened or narrowed, so that an obstruction is placed in the course of the blood current ("roughening," "obstruction," "stenosis"), or by preventing their closure, thus permitting the blood to leak backward or regurgitate ("insufficiency"). (Fig. 21.)

Lesions of the pulmonary valve are almost always of congenital origin. I have, however, seen cases in pneumonia and syphilis. Congenital heart disease is characterized by dyspnea, chronic cyanosis, and clubbing of the fingers. The tricuspid valve is frequently insufficient in extreme cases of cardiac failure, but this is due not to endocarditis but to excessive dilatation of the right ventricle. The valves are not large enough to close the widely stretched opening between the auricle and ventricle. It is therefore spoken of as relative insufficiency. In myocarditis with loss of compensation there is also relative insufficiency of the tricuspid valve and of the mitral valve.

The mitral valves are frequently involved, particularly in rheumatic disease. There may be insufficiency or stenosis; in the latter case the leaflets of the valve are sometimes glued together leaving only a buttonhole-like opening. Stenosis and insufficiency may be combined, but usually one lesion or the other predominates. In mitral insufficiency the heart is enlarged transversely (both ventricles) and dyspnea and edema are the first signs that appear when the heart weakens. With loss of compensation the whole sequence of symptoms characteristic of insufficiency of the heart makes its appearance. Under suitable conditions of life patients with a healthy heart muscle may live for many years in com-

parative comfort. Sudden death is exceptional. In mitral stenosis the pulse is often irregular. The heart is enlarged to the right and a thrill is felt near the apex, just before the impulse of the heart. This and the corresponding presystolic murmur is characteristic of the disease. With beginning cardiac embarrassment the patients suffer from nosebleed, orthopnea, precordial pain, and palpitation. Later on, the ordinary symptoms of cardiac insufficiency develop. Embolism, although it occurs in all forms of heart disease is unusually frequent in mitral stenosis. The emboli lodge most often in the kidney, spleen, or brain. In the latter instance hemiplegia develops.

True aortic stenosis is much less common than aortic insufficiency. Roughening, which is often mistaken for narrowing of the valve, is very common. In stenosis, in addition to the murmur, there is a small, "slow" pulse. The face is sometimes pallid and attacks of syncope or evidences of mental impairment occur. Aortic insufficiency, on the other hand, is accompanied by very characteristic signs and symptoms. The heart is greatly enlarged downward and to the left. The pulse is full, soft, and collapsing (Corrigan pulse). The capillary pulse is present as well as other characteristic signs (murmurs in the heart and arteries, *e. g.*) which can only be appreciated by the use of the stethoscope. As long as the valvular lesion is fairly well compensated, the ordinary symptoms of cardiac insufficiency are absent, but the patients may suffer acutely from nocturnal anginoid pains and cardiac "asthma." Sudden death is frequent in aortic insufficiency.

Multiple lesions, aortic insufficiency or stenosis, with mitral insufficiency or stenosis in all possible combinations, are not at all unusual. I once performed an autopsy on a patient who had been under the care of two physicians, a father and son, for over sixty years. She had almost complete obstruction at both the mitral and aortic valves. Another similar case seen about the same time lasted for more than thirty years. The prognosis of rheumatic

valvular disease, if the heart muscle is good, and the patient well cared for, may therefore be excellent. Syphilitic lesions being usually progressive are less hopeful.

Treatment of Acute Endo- and Myocarditis.—**Prophylactic Treatment.**—The development of endocarditis may doubtless be prevented in many cases by the removal of large tonsils, and by proper treatment of gonorrhea and other local infections which may give rise to this disease. Rheumatism should be treated from the beginning with efficient doses of salicylates to prevent the extension of the process to the endocardium. Similarly, myocarditis may be prevented from working serious harm, if prolonged

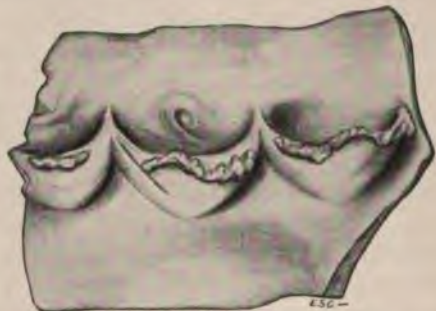


FIG. 23.—Warty endocarditis of aortic valve. (Adami and McCrae.)

rest is instituted in those infections, such as diphtheria and influenza, in which it is liable to give rise to serious consequences. In diphtheria it may be sufficient to avoid exertion for a month or six weeks. In severe influenza the symptoms of cardiac weakness may persist for months. Acute myocardial degeneration will usually require no medicinal treatment beyond strychnin and tonics. In acute endocarditis, if the heart is rapid and irritable, the ice-bag may be employed as in pericarditis. Morphin and bromides may also be used for the purpose of quieting the heart action. Rest in bed, if not already prescribed for the primary disease, should be made absolute. Only

in cases of severe dyspnea would a partially elevated position be adopted. Rest includes the use of the bed-pan and urinal, as well as feeding the patient by hand. Visitors, except those closest to the patient, should be barred. Acute heart failure, if it should unfortunately occur, would require the hypodermic administration of strychnin, camphorated oil, etc. If the case develops the symptoms of cardiac insufficiency, the treatment described below will apply.

The Treatment of Cardiac Insufficiency.—The treatment of cardiac insufficiency, whether due to loss of compensation in valvular disease or to simple dilatation and hypertrophy, is about the same. The patient should be placed in a bed with a firm mattress and if orthopneic, should be propped up in a comfortable position. Properly arranged bed-rests are better than pillows, as they give a firmer support and the patient is less likely to slip down. As he becomes less dyspneic, the rest should be gradually lowered, as the strain on the heart is much less in the horizontal position. On account of the edema, chafing and irritation are particularly liable to occur, but can be minimized by careful nursing. If the dropsy is not promptly dispelled by medicinal means the physician may take measures to withdraw the fluid from the chest (see page 136) by aspiration, from the abdomen (Part V, Chap. IV) by the trocar and cannula, and from the subcutaneous tissues by incision, or by means of Southey's tubes. The latter are fine silver cannulas which are thrust into the subcutaneous tissues of the lower extremities, and attached to small rubber drainage tubes. Scrupulous cleanliness both before and after this treatment is necessary to avoid infection. Sweating by the hot-air bath or vapor bath, as a method of removing dropsy is contra-indicated in cardiac failure. If pulmonary congestion is pronounced, cupping is a useful measure. A half-dozen or more cups, or as many as the surface will accommodate should be applied simultaneously.

If the patient is unusually cyanotic, free venesection

is a life-saving measure. This little operation may be briefly described at this point, although its usefulness is not limited to cardiac disease. Venesection is frequently employed in uremia, particularly if there is high blood-pressure, in apoplexy, and in the early stages of pneumonia (in the robust). After the skin at the bend of the elbow has been disinfected in the usual manner a few turns of bandage are placed about the upper arm and tightened until the superficial veins are distended. If the congestion is still insufficient the patient may be asked to grasp a stick. An incision is then made obliquely through the vein with a sharp scalpel or lancet. After eight ounces or more of blood have been obtained the



FIG. 24.—Venesection. (Heath.)

bandage is loosened and a sterile gauze pad is secured over the vein by a few turns of bandage. Venesection may also be performed by opening the vein after it has been dissected out as for intravenous infusion, or a large hollow needle may be thrust directly into the vein without preliminary incision of the skin. It is difficult by this last method, however, to withdraw more than a few ounces of blood.

Medicinal Treatment.—The remedy *par excellence* in cardiac insufficiency with dropsy is digitalis. Of this there are numberless preparations, none of which is more efficacious, though some may be less nauseating, than the leaves themselves. The dose of the leaves is $\frac{1}{2}$ to $1\frac{1}{2}$ grains, administered in pill or capsule. It is a common practice

to precede the administration by a large dose of mercury (5 to 10 grains), or to combine it with a smaller one ($\frac{1}{2}$ to 1 grain), the purpose being if possible to relieve the congestion of the gastro-intestinal tract by free catharsis. Digitalis is administered in moderately large doses for a day or two, to obtain the full effect, and then the dose is reduced to avoid the danger of poisoning. The pulse should be recorded and the quantity of urine carefully measured, both before and after the administration of the drug, as a favorable effect will be indicated by a full, slow pulse and a profuse excretion of urine (diuresis). The effect of digitalis is ordinarily most happy, though a large part of the benefit, sometimes attributed to this or other drugs, may often be obtained by rest alone. Other preparations of digitalis universally used are the infusion, the tincture, and the essential principles (digitalin, etc.), but the last mentioned are not very reliable. Strophanthin, the essential principle of strophanthus, a drug closely related to digitalis, is much more effectual in an emergency. The dose is very minute and should be injected intravenously. Squills and caffeine are often used with digitalis to supplement its action. Theobromine and theophyllin are employed to promote diuresis and relieve dropsy. They are not heart stimulants. With treatment such as that described, the majority of patients, at least in their earlier attacks, recover a greater or less degree of compensation, and many are able to return to their usual occupations.

After the dyspnea and edema have disappeared, or, in cases in which these symptoms have never been a marked feature, there may still be distress on slight exertion. This means that the patient's reserve is very small. Under these circumstances it is the object of the physician to strengthen gradually the heart muscle and to accustom the organ to an increased amount of work by means of baths, methodical exercises, etc. In Germany these methods have been systematized, but have perhaps been overdone. In this country the opposite holds true.

The best-known hydrotherapeutic method is that which originated at Nauheim. This consists essentially in the administration of daily saline baths, which contain variable amounts of carbonic-acid gas, and are of gradually increasing concentration and duration, and of diminishing temperature. The effect of the cold water is to raise the blood-pressure and to retard the pulse while the carbonic-acid gas stimulates the skin and obviates the sensation of cold. Used with judgment they improve the circulation and increase the strength and tone of the heart muscle. Another method of strengthening the heart muscle is by graduated exercises. In one system resistance exercises are employed. The patient executes a series of movements against a passive resistance given by the operator, or is exercised by machines (Zander apparatus). Another system is by ordinary gymnastic exercises especially adapted to the patient's needs. Finally, the best and simplest method, at any rate for the less advanced cases, is by graduated walks, hill climbing, and similar exercise. In patients with heart disease, who have good compensation, it is well to encourage regular but mild exercise, stopping short of weariness. For this perhaps nothing is better suited or more capable of nice adaptation than the game of golf.

The treatment of many distressing symptoms which arise in the course of heart disease has already been alluded to in the appropriate sections, *e. g.*, anginoid pains, under Angina. Digestive disturbances resulting from passive congestion in the stomach are a frequent cause of complaint and have not been sufficiently emphasized. They are principally manifest as belching, distention, and precordial distress. The meals should not be too large and may be supplemented by lunches. Articles likely to give rise to flatulence, such as beans, cabbage, and coarse root vegetables, should be excluded from the dietary. The quantity of fluid may often be restricted with advantage. Creosote in small doses, cardamom, spirit of chloroform, aromatic spirit of ammonia, soda mint, and similar remedies are the remedies most likely to prove beneficial.

PART IV.

DISEASES OF THE UPPER AIR PASSAGES, LUNGS, PLEURA.

GENERAL CONSIDERATIONS.

Respiratory Movements.

Dyspnea.

Aphonia.

Cough.

Sputum.

Epistaxis.

Physical Signs of Respiratory
Disease.

DISEASES OF THE UPPER AIR PAS- SAGES.

Rhinitis.

Hay-fever.

Pharyngitis, Tonsillitis, and
Adenoids.

Acute Laryngitis.

Spasmodic Croup.

Bronchitis.

DISEASES OF THE LUNGS.

Bronchopneumonia.

Hypostatic Pneumonia.

Pulmonary Edema, Infarcts, etc.

Asthma.

Emphysema.

Tumor, etc.

DISEASES OF THE PLEURA.

Pleurisy.

Empyema.

Pneumothorax.

Hydrothorax.

GENERAL CONSIDERATIONS.

Respiratory Movements.—Respiration may be costal, abdominal, or costo-abdominal. These terms show the direction in which expansion chiefly takes place and indicate whether the intercostal muscles or the diaphragm are principally brought into play. In women the costal type prevails, while in men the abdominal or costo-abdominal is usual. The type of respiration may be altered in disease; in ordinary pleurisy the chest may be almost motionless while in painful abdominal affections diaphragmatic breathing is limited. In severe dyspnea the accessory muscles of respiration, chiefly of the neck and abdomen,

are visibly contracted, *e. g.*, the sternomastoids and trapezii. In adults under normal conditions there are sixteen to twenty-four respiratory movements a minute. The relation to the pulse is roughly one to three or four. In infants or young children the respiratory rate is almost double the adult rate. Inspiration and expiration require about the same length of time but the inspiratory murmur (heard on auscultation) is four or five times as long as the expiratory.

Dyspnea.—In dyspnea inspiration or expiration may be labored, or respiration may be merely exaggerated in depth or increased in frequency. Dyspnea if severe is often associated with blueness (cyanosis). Inspiratory dyspnea is most often due to spasm or obstruction and is accompanied by stridor. It may be seen, for example, in spasmodic croup, edema of the glottis, and external pressure by aneurysm. Expiratory dyspnea is seen in asthma, chronic bronchitis, and emphysema. Inspiration in asthma is comparatively easy but expiration is painfully prolonged and wheezing. A special type of dyspnea ("air hunger"), which is peculiar in that both inspiration and expiration are unusually full and deep, is seen in diabetic coma. Cheyne-Stokes respiration, alluded to under Myocarditis and Uremia, is remarkable on account of its rhythm. The respirations, at first almost imperceptible, increase in depth in a step-like fashion until they reach a noisy acme and then as gradually fade away and may cease altogether for a brief space. The whole cycle occupies about a minute.

Aphonia.—Hoarseness or aphonia is a common symptom of laryngitis and other affections of the larynx—tuberculosis, tumors, etc. A nasal quality in the voice is usually due to obstruction in the nose or nasopharynx (adenoids); it may be caused by deficiencies of the palate, congenital or acquired (cleft palate, syphilitic ulceration).

Cough.—Cough is usually described as either "dry" or "loose;" in the former variety the sputum is scanty and tough or altogether absent, in the latter, abundant

and more or less fluid. Free secretion and a loose cough may exist without expectoration, particularly in children (sputum swallowed). A dry cough usually has a ringing or barking quality. A hacking cough is often due to nothing more serious than irritation of the pharynx. In pertussis a series of paroxysmal coughs ends with a loud, sharp, inspiratory whoop. The inspiratory crow of laryngismus is independent of cough. Hawking is a voluntary expiratory movement employed to "clear the throat;" it is not identical with cough.

The Sputum.—The sputum varies greatly in consistency, from the frothy, serous sputum of edema of the lungs to the tough, tenacious variety seen in pneumonia. Serum and mucus in varying proportions constitute the greater part of most sputa. Pus or blood may be present in quantity or in traces, hence the prevalent terms mucopurulent, bloody, rusty, etc. Coal dust (in miners) lends a black color to sputum; jaundice, a greenish-yellow tinge. In certain grave cases of pneumonia the sputum resembles prune juice. In tuberculosis firm, greenish-yellow masses are seen floating in a thinner material; these have been fancifully compared to coins, hence the term "nummular." In gangrene of the lung, dilatation of the bronchi, and tuberculosis with cavitation, the sputum acquires a horrible fetid stench or a sweet, sickening odor hardly less disagreeable. Microscopic examination of the sputum is of great value, particularly in the diagnosis of tuberculosis and pneumonia. The sputum is collected and suspicious particles picked out and stained. For the tubercle bacilli the carbol-fuchsin stain is usually employed. This stains the organisms a deep red and the remainder of the slide blue. Pneumococci, streptococci, influenza bacilli, etc., are frequently demonstrated by appropriate stains.

Epistaxis.—Epistaxis or nosebleed may be due to local or general causes. As examples of the latter may be instanced high blood-pressure and typhoid fever; of the former, ulceration and inflammation. It is usually not

serious and ceases either of itself, or after the use of simple measures, such as sprays, the application of cold, adrenalin, etc. In severe cases (*e. g.*, in "bleeders") packing of the anterior or posterior nares is required. To pack the posterior nares a special instrument (Bellocq's cannula) is convenient, but the following method will suffice in an emergency. A long, stout silk ligature is threaded through the eye of a soft-rubber catheter. The catheter is passed through the nares into the throat until its



FIG. 25.—Packing the posterior nares. (Ferguson.)

point is seen back of the soft palate. One end of the silk ligature is then seized by a pair of forceps and drawn out of the mouth while the other end is withdrawn through the nose by the aid of the catheter. A pledget of gauze of sufficient size to fill the nasopharynx is attached to the middle of the ligature and is guided into position by its aid. The anterior nares are then packed from behind forward.

Physical Signs of Respiratory Disease.—The diagnosis of respiratory diseases depends in large measure on

physical signs, but as these signs cannot as a rule be utilized by the nurse they will receive only brief notice. An increase of secretion in the bronchial tubes causes bubbling sounds, known as rales, which can be heard by the ear applied to the chest. If the secretion is scanty and tough the rales have a whistling or snoring character ("dry rales"), if free and liquid, a bubbling character ("moist rales"). When the fluid is abundant in the trachea or bronchi, as in advanced edema of the lungs, the bubbling sounds ("death rattle") are easily heard at a distance. Consolidation of the lung is indicated by a "dull" sound on percussion over the area affected, by changes in the normal respiratory murmur (bronchial breathing), by increased transmission of the voice sounds through the chest wall, and by special rales. Fluid in the chest is indicated by restriction of the movements of the chest, a "dull" or "flat" sound on percussion, and by distant breath and voice sounds. Sometimes the fluid changes its level with change of position or pushes the heart to one side or the other. Roughening of the pleura (dry pleurisy) is indicated by rubbing sounds ("frictions") heard by the ausculting ear.

DISEASES OF THE UPPER AIR PASSAGES.

Acute and Chronic Rhinitis.—Acute rhinitis, coryza, or cold in the head, is an acute infection which may apparently be evoked by a number of microorganisms. Similar symptoms may also be brought about by constitutional conditions, congestion, and various irritants. Many persons with all the symptoms of acute cold in the head, will be immediately relieved by local treatment, followed by a laxative and a salicylate. Nose and throat specialists usually attribute these cases to the so-called "gouty diathesis." The action of certain irritating vapors (bromin, boiling sulphuric acid, etc.) will also call forth transient symptoms of similar character.

The ordinary infectious variety begins with sensations

of chilliness, sneezing, and stuffiness in the nose. There may be slight fever and malaise. These are succeeded by a stage of profuse watery secretion, and this in turn by a stage of decline with mucopurulent or purulent discharge. In many cases there is more or less pain above or at the inner side of one or both eyes. This is due to congestion of the frontal sinuses which connect with the nose. In the more severe cases the pain will be intense and paroxysmal, and will be associated with marked tenderness and sometimes with redness, swelling, and edema. Other sinuses connected with the nose may also be involved. If the inflammation of a sinus becomes purulent, it is sometimes necessary to open, curette, and drain. Acute rhinitis is prone to involve the pharynx, larynx, and bronchi secondarily, but if uncomplicated clears up in a week or ten days. It seems to be more contagious at one time than another, probably depending upon the exciting organism or upon its virulence. On account of the frequency of the disease, it is not practicable to carry out isolation, but frail and susceptible persons should be protected from infection so far as possible, by preventing close contact with those who are infected.

Treatment.—The curative treatment of acute rhinitis is not satisfactory, although most persons have some favorite plan which they find more or less efficacious. In the early stages elimination by the skin, bowels, kidneys, and the diminution of internal congestion are the special objects of treatment. For these purposes Rochelle salt with sodium bicarbonate, Dover's powder, Turkish or cabinet baths, potassium citrate, and tincture of aconite are used separately or in combination. Later belladonna (atropin) is employed to check excessive secretion and to promote drainage from the sinuses. Quinin, strychnin, ammonium chloride, and camphor probably act as general or local stimulants. Oily sprays and ointments are used in the early stages and mild alkaline and antiseptic sprays and douches in the later stages.

The prophylactic treatment is of greater value and

importance. The most important prophylactic factors are cool, well-ventilated living rooms (winter), cool or cold morning baths, daily exercise in the fresh air, regulation of the bowels, moderation in food and drink, and attention to local disorders of the nose and throat.

Chronic rhinitis is of several varieties, two of which may be mentioned. In hypertrophic rhinitis, there are chronic congestion and thickening of the mucous membranes, increased secretion, and more or less obstruction. Rhinitis of this type is aggravated by repeated acute attacks, by cold humid climates, and by constitutional conditions. It is often susceptible of great improvement and cure by local treatment, change of climate, or correction of general medical conditions. Atrophic rhinitis on the other hand, is characterized by pallor and smoothness (atrophy) of the mucous membranes, diminution of secretion, crusting, and an extremely foul odor to the breath (ozena). The nasal passages are free. As this condition is dependent on atrophy complete cure is not to be expected. The patients may secure relief from the distressing odor, which is, however, not apparent to them, by appropriate douches (potassium permanganate, etc.). Tertiary syphilis with ulceration and bone destruction may produce a similar foul discharge.

Hay-fever.—Hay-fever is a disease which is induced in the nasal and conjunctival mucous membranes by the pollen of certain plants, particularly of the rose, ragweed, and grasses. These irritants do not affect ordinary persons but only those who are predisposed. Hay-fever is therefore sometimes considered to be a neurosis, but there is more evidence to connect it with certain so-called anaphylactic conditions. The typical example of the latter is seen in those persons who develop hives, rashes, etc., after a small dose of horse serum (diphtheria antitoxin). Rose-cold develops in the spring when roses are in bloom. It is not, however, so common as the ordinary hay-fever, which develops in August and September, and which is attributed to ragweed and the grasses. Attacks

of hay-fever usually begin on a definite date (neurosis?) and are characterized by sudden, intense congestion of the nose, profuse discharge, redness of the eyes, lachrymation, and sneezing. This is easily relieved by a sea voyage or removal to certain mountain districts where the irritants which cause the disease do not exist. The attacks may last for a number of weeks and recur each succeeding year. Patients may subsequently develop asthma. Ordinary nose and throat treatment causes a certain amount of relief but is not curative. In the last few years a prophylactic serum known as Dunbar's Pollantin has been used with considerable success. This is instilled into the eyes and nostrils by means of a pipette.

Pharyngitis, Tonsillitis, and Adenoids.—Diseases of the pharynx and nasopharynx, although often discussed under the digestive system, are more naturally included with the respiratory tract. Acute and chronic pharyngitis are commonly associated with the similar conditions in the nose which have already been described. The use of the voice and the abuse of alcohol and tobacco are causes which may lead to a special involvement of the pharynx (see Chronic Laryngitis).

The most important diseases of this region are those affecting the adenoid tissue. This tissue occurs in three principal situations. In the roof of the nasopharynx there are folds of lymphatic tissue which are usually spoken of as "adenoids." There are also large collections of adenoid tissue on each side of the throat between the pillars of the fauces. These almond-shaped masses are commonly known as the tonsils. Another mass of adenoid tissue which sometimes becomes engorged and leads to a distressing, tickling cough is found at the base of the tongue and is known as the lingual tonsil. The adenoid tissue of the nasopharynx and of the tonsils is very prone to chronic hypertrophy or overgrowth. This is especially deleterious in the case of the former because it leads to more or less complete blocking of nasal breathing. Enlargement of the tonsils causes a lesser degree of

obstruction and sometimes induces irritating cough or stridor. These enlarged masses of lymphoid tissue are also liable to harbor infection and thus give rise to recurring inflammatory attacks in the upper air passages or to chronic enlargement of the glands of the neck.

Adenoids proper have a special symptomatology which is often characteristic. Newborn infants rarely suffer,

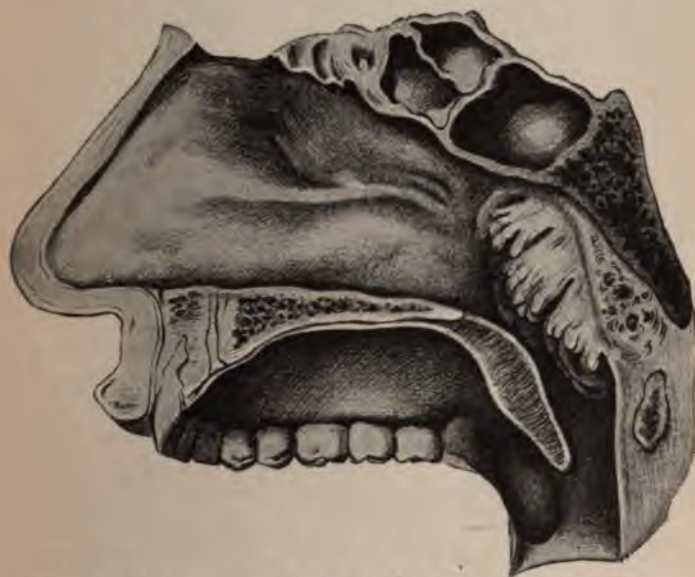


FIG. 26.—Anteroposterior section of the head of an adult, showing the situation and gross structure of hypertrophy of the lymphoid tissue of the nasopharynx. (Zuckerkindl.)

though symptoms may occasionally begin in the first year, and the obstruction may be sufficient to interfere with nursing. The more aggravated cases are seen in and after the second year, and are characterized by mouth breathing, snoring at night, liability to acute respiratory infections, mental dulness, and certain physical changes, such as narrow, pinched nostrils, high palatal arch,

irregularities of the teeth, and in the rachitic, deformities of the chest. Adenoid vegetations usually disappear spontaneously before adult life.



FIG. 27.—Examination for adenoids. (Koplik)

Treatment.—Medical treatment of adenoids is of little avail; if there is any considerable obstruction, they should be removed as soon as the child is able to undergo the

operation with impunity, usually after the second year. Enlarged tonsils should be removed if they are of unusual size or badly infected. A focus of infection in these glands may be the cause of repeated attacks of rheumatism or endocarditis. In adults treatment by cautery, etc., is sometimes sufficient. Acute infections of the tonsils are described in the chapter on Infectious Diseases.

Acute Laryngitis.—Acute catarrhal laryngitis is a very common infection, particularly in cold, raw climates or in the cold seasons of the year. It is more common in those who overstrain their voices, for example singers, hucksters, and clergymen. It is usually a trivial affection accompanied by slight fever, hoarseness, aphonia, and dry cough. At night the cough is often more severe and there may be inspiratory dyspnea with stridor. It may last from a few days to two weeks and is frequently associated with rhinitis, pharyngitis, or bronchitis.

Spasmodic Croup.—In young children there is a mild form of catarrhal laryngitis associated with recurring nocturnal attacks of severe spasmodic croup. The attack is characterized by a croupy cough and by severe and often alarming inspiratory dyspnea which wears away after several hours, but may recur on successive nights. In certain families there seems to be a special liability to spasmodic croup (in adult members, to asthma). This is the affection which is responsible for the inclusion of syrup of ipecac in the pharmacopœia of the nursery.

Laryngismus stridulus is a nervous affection seen in ill-nourished, rachitic infants. It is characterized by nocturnal attacks of "holding the breath" with blueness and threatened asphyxia, which terminate in a peculiar "crowing" inspiration. In these cases there is no catarrh of the larynx. Membranous croup is an old-fashioned name for diphtheria of the larynx.

Chronic laryngitis is due to a continuation of the same causes which occasion acute laryngitis and is accompanied by thickening and other changes in the vocal cords. It is largely an occupational disorder.

Acute laryngitis is treated by inhalations of steam, plain or medicated, by ipecac, tartar-emetic, rest of the voice, etc. The general measures advised in acute rhinitis are also useful. In spasmodic laryngitis ipecac should be given in emetic doses. Sedatives such as bromides are also useful. Chronic laryngitis requires rest and local treatment of the vocal cords. For those who can afford it, change of climate is valuable.

Other important diseases of the larynx, all of which may cause hoarseness or aphonia, are tuberculosis, syphilis, cancer, benign tumors (polyps), and edema of the glottis. Most of these have been described under the appropriate headings, and in most cases will depend for their diagnosis on laryngoscopic examination. The prognosis in tuberculosis or cancer is extremely bad. In benign tumors, the voice may be restored by removal of the tumor either by operation or the *x*-rays. Hysterical aphonia offers a favorable prognosis. Edema of the glottis may accompany generalized edema, as in Bright's disease, or may result from acute inflammation. As a rule it begins suddenly with increasing dyspnea (both inspiratory and expiratory) due either to swelling of the epiglottis or to infiltration of the surrounding soft tissues. The course is usually very rapid, and requires scarification of the epiglottis or immediate tracheotomy.

Bronchitis.—Bronchitis is a term which is commonly applied to inflammation of the trachea (tracheitis) and of the large and medium-sized bronchial tubes. The same process, if it extends to the finest bronchioles, is called capillary bronchitis. This is seldom distinguishable from bronchopneumonia in which the pulmonary vesicles are also inflamed. Ordinary acute bronchitis involves the trachea and large bronchial tubes and often presents no characteristic physical signs. It is accompanied by the usual symptoms of a mild fever, by soreness beneath the sternum, and by cough, which is at first dry and racking, with little or no sputum. After a day or two, the cough becomes looser and the sputum which is at first

mucoid and scanty, becomes profuse and mucopurulent. The fever rarely lasts more than a few days, and with it the aching and other constitutional symptoms disappear. After persisting for two or three weeks the cough gradually clears up.

In the young and aged and in those who are subjected to repeated attacks, symptoms may be much more severe with involvement of the smaller bronchi. When the ear is laid upon the patient's chest, bubbling, whistling, snoring, and crackling sounds are heard. The first are known as moist rales and the others as dry rales. In children the bronchial secretion may produce considerable obstruction and induce attacks of suffocation with cyanosis and collapse which require the prompt use of emetics, mustard baths, and other counter-irritants. In the young, the aged, and the debilitated, bronchopneumonia is a common complication. Bronchitis frequently occurs as a secondary condition in congestion due to heart disease, in inflammatory diseases of the lung, in infectious diseases (such as typhoid fever, influenza and whooping-cough), in constitutional disorders (such as gout and Bright's disease), and finally in asthma and emphysema. When it is complicated with asthma and emphysema there is usually severe dyspnea with wheezing.

Chronic bronchitis is a term used to designate cases in which there is more or less continuous cough with brief intervals of freedom. In the so-called "winter cough" the patient is usually free from symptoms in the summer months, but with return of cold weather the cough recurs and persists until the following spring. The patient's general health may be comparatively little effected, but in severe and prolonged cases, emphysema, dilatation of the bronchi, and embarrassment of the heart may finally ensue.

Treatment.—The prophylactic treatment of bronchitis depends on the removal of the cause when this is possible. The disease is more prevalent in damp, cold, changeable climates, so that much may be gained by removal to a

dry, warm atmosphere, or even to a dry, cold one. Acute cases are benefited by a change of climate of even less radical nature, as from the city to the seashore, or from the shore to the mountains. Some cases are occasioned by exposure to dust or gases incident to certain occupations, and may be relieved by the use of ventilators or

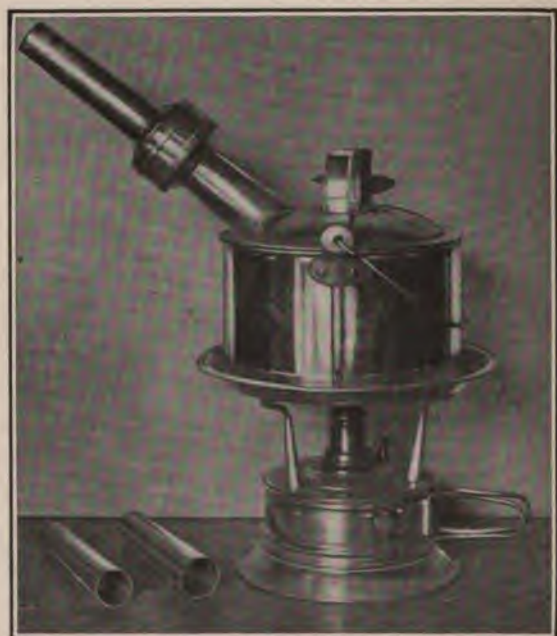


FIG. 28.—The croup kettle. (Hare.)

respirators. In a similar way, the treatment of underlying gastric, cardiac, renal, or other disease may cure an otherwise intractable cough. For analogous reasons stimulants, tonics, and alteratives (strychnin, arsenic, iodide of iron, and cod-liver oil) are useful.

In the early stages of acute bronchitis a simple fever

mixture is usually employed, containing potassium citrate, spirit of nitrous ether, etc. At the same period "sedative expectorants," such as wine of antimony, syrup of ipecac, and apomorphin hydrochloride are used to relax the cough. As the case progresses "stimulant expectorants" which increase secretion and aid in its expulsion come into use. Examples are ammonium chloride, senega (syrup), terebene, terpin hydrate, tar, and creosote. The latter class of remedies is also useful in chronic bronchitis. If the cough is excessive, demulcents, such as licorice and flaxseed, or sedatives, such as bromides, spirit of chloroform, hydrocyanic acid, codein, Dover's powder, and other opium preparations are required. In children opium in all forms should be used with great care and expectorants are best employed in the form of inhalation. Compound tincture of benzoin, creosote, and many other substances may be given in this way, although the beneficial results are largely due to the relaxing effects of the steam. In the same class of patients as well as in the aged, counter-irritants are employed, dry cups, mustard paste, camphorated oil, etc. In the early stages of bronchitis, rest in bed in a well-ventilated but fairly warm (65° to 70°) room, undoubtedly shortens the attack. In the later stages fresh air in abundance or actual open-air treatment has its place.

DISEASES OF THE LUNGS.

Bronchopneumonia (Catarrhal Pneumonia).—Bronchopneumonia or lobular pneumonia involves, as these appellations imply, small lobules or groups of vesicles which open into a single minute bronchus (bronchiole). It may be caused by a great variety of organisms. It differs from the specific infectious disease "pneumonia" (see Infectious Diseases) in that the latter involves a whole lobe almost from the beginning and is always due to the pneumococcus. It runs an irregular course and commonly is preceded and accompanied by bronchitis. The fever is not high,

as a rule, but respiration is rapid and cyanosis marked. Bronchopneumonia is a common cause of death in measles, whooping-cough, and other diseases of infancy and early childhood and again in the infirm and aged. The treatment is partly that of bronchitis and partly of pneumonia. Stimulation and careful feeding are important. Fresh air is valuable, but opinions differ as to the propriety of cold which is so beneficial in the lobar variety.

Hypostatic Pneumonia.—Hypostatic pneumonia is a condition that succeeds congestion of the dependent parts of the lungs in cardiac cases and in weak and bed-ridden patients. It is frequently the "last straw" which finally turns the balance, but is to be regarded as a contributing rather than a principal cause of death. Aspiration pneumonia is a somewhat similar condition due to sucking of food or other foreign particles into the bronchi and air vesicles with subsequent infection. The natural defences (cough, etc.) suffice to prevent this in the normal individual, but these may be overcome by destructive disease of the larynx, perforation of the esophagus or aorta into the bronchus, and a variety of other causes as well as by extreme debility, stupor, anesthesia, etc. This, again, is a very fatal form of pneumonia. Chronic interstitial pneumonia is a fibroid induration of the lung resulting, as a rule, from chronic irritation by coal dust, marble dust, and other mechanical irritants peculiar to various trades. Such a condition is sometimes called pneumoconiosis and as a rule is complicated by tuberculosis (chronic fibroid phthisis). The symptoms are chronic cough and emaciation. It bears no resemblance to the conditions described above except in name.

Pulmonary Edema, Infarcts, etc.—The same causes which lead to hypostatic pneumonia may also induce edema of the lungs. In this condition fluid accumulates in the vesicles and bronchi giving rise to bubbling sounds. Edema of the lungs is found in a large proportion of all cases at autopsy, but is in itself not necessarily a fatal condition. Infarcts have been mentioned in Part III,

Chapter I; they result from the lodgment of emboli in the small arteries. In this condition cone-shaped areas of consolidation, usually red in color and with the base outward, are found at the surface of the lung. The physical signs are those of pneumonia but the symptoms may be suggestive or diagnostic. The most important are sudden pain in the chest and the expectoration of deeply blood-tinged sputum or pure blood. If the clot or embolus which causes the infarct is infected (pyemia, malignant endocarditis), gangrene or abscess of the lung may develop. Gangrene and abscess may also occur after pneumonia or from the aspiration of infective material. Under these conditions the patient runs an irregular hectic fever, often with sweats and chills, and expectorates either pus in the one case, or fetid gangrenous material in the other.

Asthma.—Asthma, or bronchial asthma, is a spasmodic affection which is frequently associated with bronchitis. It occurs in paroxysms, commonly at night, and compels the patient to sit up in bed or to go to the window to catch his breath. Inspiration is only slightly impeded but expiration is prolonged and wheezing; the patient cannot get the air out. The face is cyanotic, the muscles of the neck prominent and contracted. When the attack has passed relaxation occurs and sleep is again possible. Asthma is sometimes a sequel of hay-fever and like that disease is supposed to be more common in neurotic people. The prognosis for the attack is good, for permanent cure, bad.

Treatment.—Occasionally the treatment of some nasal condition or of a gastric anomaly may bring about cure. Attacks of bronchitis aggravate the asthma and in association with it lead to emphysema. Potassium iodide has a favorable effect on the disease. The attack itself is relieved by atropin or atropin and morphin administered hypodermically, or by the inhalation of the fumes of burning saltpeter usually mixed with belladonna, or stramonium leaves in varied combination. These are the

principal constituents of the ordinary "asthma pastilles" and "asthma cures."

Emphysema.—Emphysema is a disease characterized by an increased volume of the lungs, due to permanent distention and loss of elasticity. The lung completely fills the chest and does not retract as it should during expiration. The chest is round or barrel-shaped and moves very slightly with respiration which is almost entirely diaphragmatic. The accessory muscles of respiration are brought actively into play. The patient has trouble in emptying his lungs, and is sometimes somewhat cyanotic. In protracted cases hypertrophy and dilatation of the heart commonly develop. Emphysema of moderate degree is normal in extreme old age, but severe cases usually result from prolonged cough, hard work, and, it is generally believed, from such occupations as glass-blowing and the use of wind instruments. Emphysema is an incurable disease which may be aggravated by hard work or by repeated attacks of asthma and bronchitis. Treatment is concerned largely with the prophylaxis and treatment of these intercurrent diseases or of cardiac complications. Aside from the ordinary form of emphysema, there is a temporary distention or hypertrophic emphysema of the healthy lung in pneumonia, pleural effusion, etc., which compensates for its crippled fellow. This condition disappears with convalescence from the primary disease.

Tumors, etc.—Tumors of the lung and pleura may occur, but they are rare. Syphilis occasionally affects the lung; tuberculosis very commonly. Both are described under their appropriate headings.

DISEASES OF THE PLEURA.

Pleurisy.—The pleura is the serous membrane which invests the lungs (visceral pleura), the inner surface of the chest (parietal pleura), and the diaphragm (diaphrag-

matic pleura). Inflammation of the pleura is known as pleurisy; sometimes it is localized in one portion of the membrane, *e. g.*, diaphragmatic pleurisy. Pleurisy is a common accompaniment of diseases of the lungs, particularly of tuberculosis and pneumonia. In these conditions there is usually a dry pleurisy which results in the formation of more or less extensive adhesions. Simple or primary pleurisy may be either dry (plastic) or serous. It may be due to a variety of microorganisms, most commonly to the tubercle bacillus and the pneumococcus. In many cases no organism can be found in the pleural fluid. Simple pleurisy generally begins with a chill or rigor, slight fever, malaise, and sharp, stabbing pain in one side of the chest. Sometimes in diaphragmatic pleurisy pain is felt in the abdomen alone, so that the disease has been mistaken for appendicitis or gall-bladder trouble. The patient restricts the movements of the chest so far as possible and favors breathing on the sound side by lying on the affected one, although this is by no means an invariable rule. Early in the disease the physician is usually able to detect a to-and-fro scratching sound due to the rubbing of the inflamed pleural surfaces against each other. Sometimes the disease proceeds no further and recovery takes place with the formation of slight adhesions. These probably cause the "stitch in the side," of which patients complain from time to time for years. Ordinarily dry pleurisy is followed by an effusion of clear fluid.

Often patients in whom the early symptoms have passed unnoticed come into hospitals with large effusions. The fluid fills the chest more or less completely, causing partial or complete collapse of the lung and relief of pain, if this has been present, by separation of the inflamed pleural surfaces. On account of the diminution of the breathing space, shortness of breath and blueness develop on exertion. The affected side is nearly motionless, while the other side shows an exaggerated movement. On examination the physician finds signs of fluid, flatness,

disappearance of the breath sounds, movable dulness on change of position, etc. The fluid may disappear of itself, or as a result of the use of diuretics, etc., but if it does not, tapping is required. Sometimes operation has to be repeated several times before recovery occurs. Uncomplicated pleurisy is seldom fatal. Even when due to tuberculosis recovery is the rule unless it is preceded or followed by pulmonary involvement.

Empyema (Purulent Pleurisy).—Empyema does not usually follow a simple pleurisy, but is common after pneumonia. It is to be suspected after the subsidence of the primary disease if an irregular temperature with or without chills and sweats develops. Examination of the blood generally shows an increase of leukocytes. Physical examination is usually decisive, but sometimes the signs of the preceding disease complicate the examination. In other cases the pus is between the lobes of the lungs and cannot be detected except by the needle. The diagnosis is confirmed by exploratory puncture and by the withdrawal of pus.

Pneumothorax.—Pneumothorax almost invariably results from the perforation of a tubercular cavity through the pleura, and is usually announced by sudden pain, shortness of breath, and the signs of free air in the chest. On examination the affected half of the chest is found to be increased in size, with a hyperresonant or drum-like note throughout. The breath sounds are masked and, if the patient is violently shaken, a loud splashing sound is heard, due to free fluid in the air-containing space. If the fluid is serous (watery), it is called hydro-pneumothorax, while if it is purulent, as is usually the case, it is known as pyopneumothorax.

Hydrothorax.—In heart disease, Bright's disease, anemia, etc., there may be a passive transudation of fluid into the pleural cavity (hydrothorax) as well as into the peritoneum (ascites), etc. This is extremely common in chronic heart disease with loss of compensation. The fluid is usually much more abundant on the right side. Some-

times the fluid disappears with rest in bed and treatment of the cardiac condition, but it may require aspiration.

Treatment of Pleurisy.—In acute pleurisy the patient should be put to bed and treated as a mild febrile case, by rest, diet, fever mixtures, etc. A laxative, for example



FIG. 29.—Removing fluid from the chest by aspiration. (After Hoppe-Seyler.)

calomel and salts, should be administered. The pain in the chest may be relieved by an ice-bag, by mustard paste or poultices, by cupping, strapping, or the hypodermic injection of morphin. Strapping is probably the simplest and most effectual method, but when the signs of the disease are in doubt it is often avoided, as it

interferes with a careful examination. After the pain disappears the patient's bowels should be kept open and diuretics administered to limit if possible the effusion of



FIG. 30.—Removing fluid from the chest by syphonage. (After Hoppe-Seyler.)

fluid. Usually aspiration will be required. For this purpose Potain's aspirator or a similar apparatus is usually employed. (Fig. 29.) It is very necessary that the apparatus should be tested before the operation is undertaken,

as the tubes or valves are likely to be obstructed or leaky or the pump out of order. In some cases trouble may be due to blood clots or thick pus, but usually the fault lies in neglect to test the apparatus in advance. After the apparatus has been assembled and the bottle exhausted it should be tested with sterile water to make sure that a vacuum is present. It would be quite possible to attach the pump wrongly and inject air into the chest instead of withdrawing fluid, with possibly serious consequences. Some physicians prefer to remove fluid from the chest by simple syphonage. For this purpose a much simpler outfit

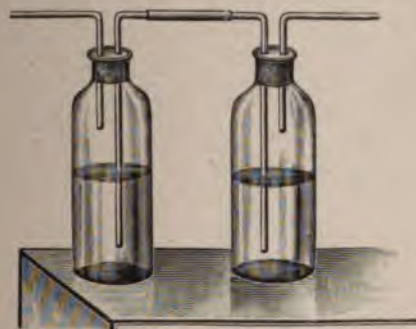


FIG. 31.—Apparatus for expanding the lung after empyema. (Hare.)

and one not liable to get out of order is required. (Fig. 30.) The fluid should be drawn off gradually and if the amount is large, too much should not be removed at one time. Otherwise the patient may develop an alarming acute edema of the lungs, characterized by the expectoration of large quantities of serous fluid. If this accident should occur a timely hypodermic of atropin and morphin will avert danger. If the fluid is loculated, *i. e.*, divided into small pockets, there may be considerable difficulty in locating it. In empyema a large needle is necessary for aspiration, as the small ones become clogged with pus. In this variety of pleurisy tapping is employed merely

to make a diagnosis. For the cure of the condition free drainage by incision and the insertion of a rubber tube is required. In pyopneumothorax tapping or draining is of little or no benefit, and is not usually recommended. In the convalescence from pleurisy the treatment should consist of rest, fresh air, tonics, and an abundance of food. This is important on account of the danger of the development of tuberculosis. After empyema the lung is collapsed and often adherent. It may usually be re-expanded by respiratory exercises, *e. g.*, by blowing fluid from one bottle into another by means of a special arrangement of tubes. (Fig. 31.)

PART V.

DISEASES OF THE DIGESTIVE TRACT
AND PERITONEUM.

CHAPTER I.

DISEASES OF THE MOUTH AND ESOPHAGUS.

GENERAL CONSIDERATIONS.

Anorexia.
Dysphagia.
Heartburn.
Belching.
Fullness and Distress.
Pain and Colic.
Vomiting.
Constipation and Diarrhea.
Lavage.
Test Meals.
Enteroclysis.

Rectal Feeding.

Miscellaneous.

DISEASES OF THE MOUTH, TONGUE,
AND SALIVARY GLANDS.

Stomatitis.
Pyorrhea Alveolaris.
Teething.
Parotitis.

DISEASES OF THE ESOPHAGUS.

Stricture and Tumor.
Hemorrhage.

General Considerations.—There are many symptoms referable to the digestive tract that are of such general occurrence that they need a separate consideration. There are also certain methods of examination which are of use in the diagnosis of many different diseases and which can be discussed at this point with advantage.

Anorexia.—Anorexia is a term used to designate complete loss of appetite. This symptom occurs in many diseases of the digestive tract as well as in fevers and chronic diseases. Increased appetite is less common and when present is suggestive of diabetes rather than of gastrointestinal disease, especially when it is associated with

great thirst. It is also noted in the convalescence from fevers and particularly in typhoid. There are rare nervous conditions in which patients, without organic disease, suffer from absolute anorexia or from polyphagia (excessive appetite); children and occasionally adults may have perverted appetites, eating clay and other indigestible substances.

Dysphagia.—Dysphagia (difficulty in swallowing) occurs in inflammation of the throat and gullet, in intrathoracic (mediastinal) tumors (aneurysm), and in the various forms of esophageal obstruction.

Heartburn.—The eructation of fluid, bitter or acid, into the throat is known as waterbrash. The nearly synonymous terms, pyrosis and heartburn, emphasize the distressing burning sensation at the pit of the stomach and beneath the sternum which accompanies this phenomenon.

Belching.—In belching, swallowed air, or less often malodorous gas produced by fermentation, is eructated, sometimes with much noisy rumbling. This may be a purely nervous habit analogous to the "cribbing" of horses. In this case the air is unconsciously drawn into the esophagus or stomach and immediately expelled. I have seen patients who have belched continuously for days, cured by the passage of a stomach tube or by a stern command. If the stomach and particularly the intestines are distended with gas, the condition is known as tympanites (from the word meaning a drum). Frequent passage of gas by the bowel is spoken of as flatulence. These conditions may be due to fermentation, but are more frequently due to disturbances of motility. Normally the gas is absorbed or expelled unconsciously.

Fulness and Distress.—Fulness and distress are sensations of discomfort which fall short of actual pain, and are usually felt in the epigastrium or pit of the stomach. This symptom is common in nervous dyspepsia, heart disease, gall-bladder disease, etc.

Pain and Colic.—Gastric pain if very severe and paroxysmal is spoken of as gastralgia. This may be met with as

an independent affection similar to neuralgia, but is more often due to ulcer and other organic conditions. A rare but severe form occurs in tabes (gastric crisis). Colic is a severe, cramp-like pain which is usually accompanied by nausea. In gall-stone colic, the pain radiates around the right side of the chest and to the "right shoulder." In renal colic it radiates from the loin downward toward the bladder. In intestinal colic and lead poisoning the pain is referred to the centre of the abdomen. In ulcer, less often in cancer, there may be localized soreness and tenderness, while in gastritis the pain is diffuse. The areas of tenderness due to ulcer, on either the gastric or intestinal side of the pylorus, and that due to gall-bladder disease are close together and sometimes indistinguishable. In ulcer there may be tenderness in the back on the left side, in gall-stones on the right.

Vomiting.—Vomiting is usually preceded or accompanied by nausea. In brain tumor it is said to be explosive in character and without nausea. Fecal vomiting is an indication of intestinal obstruction. Hematemesis or vomiting of blood occurs most commonly in ulcer and cancer of the stomach, and in cirrhosis of the liver. In cancer the blood is usually old and dark. It is compared to "coffee grounds."

Constipation and Diarrhea.—Constipation and diarrhea are relative terms which refer to the frequency and consistency of the movements. What would be diarrhea in an adult, is normal in an infant, and similar but less marked differences exist between normal adults. Complete constipation or obstipation is one of the symptoms of intestinal obstruction.

Lavage.—For the performance of lavage a stomach tube of moderately large size (32 F.) with a glass or rubber funnel is best suited. The tube should be long enough to permit of easy syphoning and should have few or no joints, as these are likely to leak sooner or later. If a bulb is required it can be attached to the outer end after removing the funnel. A bulb is often useful to free the

tube of mucus or large particles of food or to start syphoning by aspiration. After being used the stomach



FIG. 32.—The stomach tube having been passed, the funnel is filled from a pitcher and moderately elevated to force the water into the stomach. While in this position a measured amount of water may be added (a pint in all for example). Just as the last portion of water is almost to disappear down the tube, the funnel is lowered and the contents of the stomach are syphoned out. (Hare.)

tube should always be washed in cold water and then boiled.

When the tube is to be inserted it should be dipped in warm water (no other lubricant is required) and passed back to the pharynx exactly in the middle line. The patient is then asked to close the lips and to swallow, the physician meanwhile continuing to push the tube onward. If the patient has any respiratory distress he is asked to take a few long breaths, and then to swallow again. In a very few seconds the tube reaches the stomach. While the tube is being passed the head should be inclined slightly forward. The funnel is now lowered and the contents of the stomach syphoned off. If the stomach is empty the funnel is raised and a measured quantity of plain or medicated water poured into the stomach. This is now withdrawn by syphoning and the operation repeated until the stomach is clean. If there is difficulty in syphonage the tube should be inserted or withdrawn a short distance. Lavage is employed to detect retention of the stomach contents and more largely for treatment.

Test Meals.—Test meals are administered to determine the power of the stomach to secrete the digestive juices and to empty itself within a normal time. There are many forms of test meals, but that in most common use is known as the Ewald-Boas test breakfast. This consists of a large cup of tea without milk or sugar, and a breakfast roll without butter. Similar quantities of water and bread or toast may be substituted. The breakfast should be taken in the morning, fasting; if there is retention, preliminary lavage is essential. At the end of an hour a stomach tube is inserted, and the patient expels the contents of the stomach through the tube by bearing down or pressing gently on the upper abdomen; occasionally the physician will need to exert suction by means of a rubber bulb. Normally, the contents are of a purée-like consistency without admixture of mucus or blood. On examination free hydrochloric acid is found to be present, and a total acidity within definite normal limits

is determined by quantitative estimation. The quantity of stomach contents normally obtained varies from 50 to 150 c.c. ($1\frac{1}{2}$ to 5 ounces).

Under abnormal conditions the bread may be poorly digested, there may be an excess of mucus suggesting a gastritis, or traces of blood pointing to ulceration. The free hydrochloric acid may be in excess or absent, and in like manner the total acidity may be increased, diminished, or absent. In cancer, lactic acid may be found. An excess of fluid or remnants of food remaining from previous meals show that the stomach is not emptying itself as promptly as it should.

There are a large number of other test meals and modified methods of examination which we cannot attempt to describe. Recently small tubes have been passed through the stomach and into the duodenum for the purpose of obtaining the contents of the latter for examination. The stomach tube is also used to distend the stomach with air for the purpose of discovering its size and position. At the present time, if the facilities are at hand, this object may be better accomplished by *x-ray* examination.

Enteroclysis.—In many cases physiological salt solution or other medicated fluids can be given by rectum when other routes are inconvenient or impossible. Formerly the whole quantity desired was rapidly introduced, but at the present day a very gradual, continuous enteroclysis (Murphy drop method) is usually preferred. For this purpose a reservoir which can be maintained at body heat and a cut-off by which the rapidity of flow can be exactly regulated are required. (Fig. 33.) Such an apparatus may be improvised from a hot-water bag, a fountain syringe, a catheter, a hemostat, a piece of glass tubing and a straight pipette.

Rectal Feeding.—Rectal feeding is at the best a precarious method of nourishing a patient but is nevertheless of great temporary service in ulcer of the stomach, pernicious vomiting, etc. As a rule not over three feedings

of six to eight ounces each should be given in the twenty-four hours. At least one simple cleansing enema should be given daily (not just before a feeding). The "feeding" should be warmed to body temperature and introduced very slowly so as not to provoke rectal contractions. During the administration of the nutritive enema the patient should lie on the left side. He should also remain quiet for a long time after the enema has been given to favor retention. The following substances are commonly employed for rectal feeding: eggs, peptonized milk, milk-sugar, peptone solutions, etc.

Miscellaneous.—The interior of the esophagus and stomach may be viewed directly through special tubes known as esophagoscopes and gastrosopes. The technic of these examinations is too difficult and the discomfort to the patient

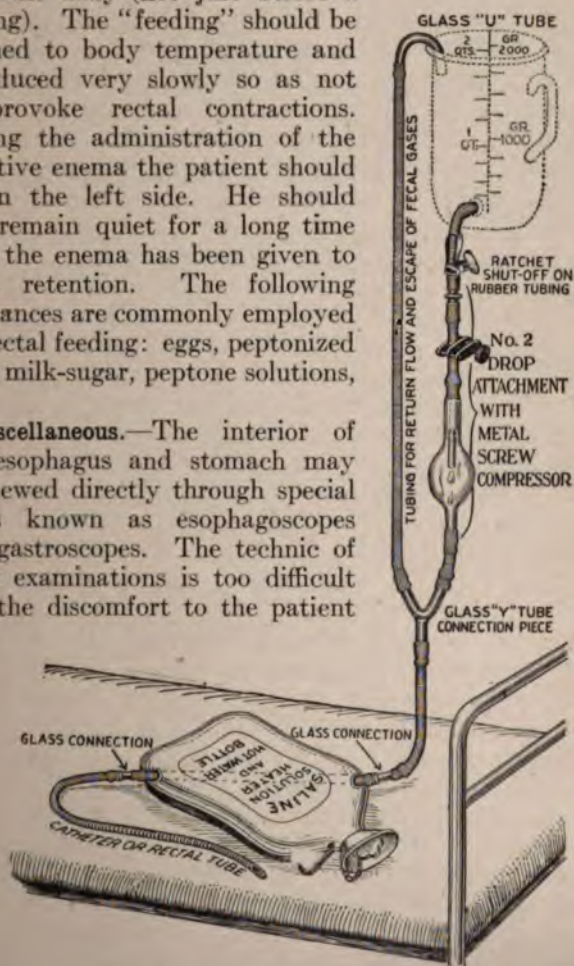


FIG. 33.—Apparatus for proctoclysis (enteroclysis). In this case the solution is heated as it flows through the tube. (Hare.)

too great to make them generally applicable. This is not true of the somewhat similar but far easier methods of examining the rectum and sigmoid. By the aid of rectal specula, strictures, tumors, ulcers, and hemorrhoids may be seen. The rectum is sometimes washed out to obtain samples for examination: more commonly the stools are examined, with or without a previous special diet for the detection of gall-stones, abnormalities in digestion, or the presence of mucus or blood. The color and consistency of the stools should be observed by the nurse and, if unusual, reported to the physician. Sticky black stools (tarry) suggest hemorrhage high up, white or clay-colored stools, with jaundice, indicate obstruction of the bile duct. Mucus and pus in large quantities are also of diagnostic importance. Blood may be detected chemically when it cannot be seen (occult blood); its presence may confirm the diagnosis of ulcer or cancer. Examination of the stools for the intestinal parasites and their eggs is also very important.

DISEASES OF THE MOUTH, TONGUE, AND SALIVARY GLANDS.

Stomatitis.—Stomatitis (inflammation of the mouth) is of common occurrence, particularly in children, and may result from hot or highly spiced food, local injuries, erupting teeth, local and general infections, and drugs. Simple stomatitis is characterized by pain, redness of the mucous membrane, salivation, and fetor of the breath. These symptoms are well marked and persistent in mercurial stomatitis. In this form the teeth frequently become loose. It is seen in susceptible persons who are taking the so-called Niemeyer's pill (digitalis, squills, and blue mass) for cardiac or renal dropsy, and in syphilitics under intensive treatment by mercury. The severer degrees with ulceration are seldom seen at the present day. In babies stomatitis is frequently accompanied by small

blisters which leave shallow ulcers; this variety is known as aphthous stomatitis.

Ulcerative stomatitis is another variety; there may be a solitary ulcer on the gums, which heals rapidly under treatment and is not accompanied by much inflammation, or in debilitated individuals and in those suffering from severe illness, there may be extensive intractable ulceration with intense inflammation.

A horrible, and fortunately, rare variety is gangrenous stomatitis ("noma"). This occurs in debilitated children after measles and other infections and may lead to perforation and destruction of the cheek. It is almost always fatal.

A severe stomatitis, frequently accompanied by ulceration, is associated with Vincent's angina. In typical cases the mucous membrane of the mouth, tonsils, and pharynx shows a soft grayish deposit which may easily be mistaken for diphtheria. Constitutional symptoms are slight or absent.

Thrush is a parasitic disorder due to a fungus and is characterized by white milk-like patches in the mouth with very little inflammation; it is seen principally in nurslings.

Leukoplakia is a condition of localized thickening of the mucous membrane of the tongue, not unlike a callus, and white ("leuko") in color. It is common in smokers and may be due to irritation, although usually attributed to syphilis.

"Mucous patches" are seen in the mouth and throat as well as on other mucous membranes, and are distinctive of secondary syphilis. They appear as oval, bluish-white or semitranslucent areas. Tertiary syphilitic ulcers are common on the tongue, palate, and throat, and in the latter situation lead to considerable destruction of tissue. Cancerous ulceration and infiltration of the tongue are also common. Tuberculous ulcers are less often seen. Many of the scars seen in the tongue are due to injury (biting), and are suggestive of epilepsy.

Formerly great stress was laid on the appearance of the tongue, but the modern view approaches that of Oliver Wendell Holmes, who when consulted by a lady in regard to a coated tongue, advised her to procure a small hoe and scrape the fur off. Defective teeth, insufficient chewing, soft or liquid food, dryness from mouth-breathing or fever, all tend to impair the normal attrition and desquamation of the epithelium which result from the thorough mastication of hard food. In chronic dyspeptics with low acidity a large, pale, flabby, tooth-marked tongue is supposed to be characteristic. In acid dyspepsias, diabetes, etc., the tongue is raw and beefy. Sometimes the tongue is denuded and atrophic. Other suggestive appearances of the tongue, such as those which are observed in scarlatina and typhoid fever, are mentioned in the appropriate sections.

Pyorrhea Alveolaris.—An indistinct blue or black line near the free edge of the gums is seen in lead poisoning. Spongy and bleeding gums occur in leukemia, scurvy, purpura, and other conditions. The most important disease of the gums from a medical point of view is pyorrhea alveolaris, which in the early stage is characterized by retraction of the gums, and later by the formation of pockets of pus¹ about the neck and roots of the teeth. The latter loosen and finally drop out, although they may not be at all decayed. Similar ulcerative and infective conditions occur about carious teeth and roots in the neighborhood of "bridge-work" and beneath plates. These minute foci of infection are believed by many physicians to be important as causes of anemia, joint irritation, and even neurasthenia, and there is little question but that they are responsible for some at least of these supposedly toxic states.

Transverse ridges on the teeth are usually signs of some severe illness which has occurred during early childhood.

¹ Recently minute organisms, known as amebæ, have been found in the pyorrhea pockets.

Irregular teeth, and particularly peg-like incisors of the second dentition, are suggestive of congenital syphilis. The role of caries in causing neuralgia has been referred to elsewhere. Extensive defects in the teeth are a prolific cause of dyspepsia (imperfect mastication).

Teething.—The influence of teething in the production of febrile and other disorders of infancy has been grossly exaggerated in the past. This has been harmful because it has been accepted as a sufficient explanation for severe diarrheas, etc., which a careful examination would have shown to have been due to remedial causes. On the other hand, it cannot be denied that irritability and even moderate fever may be due to erupting teeth.

Parotitis.—The parotid glands are those most subject to disease. Acute epidemic parotitis (mumps) is described under Infections. Inflammation of the parotid, usually suppurative, occurs as a complication or sequel of acute infectious diseases and of various abdominal disorders, such as typhoid, pneumonia, and colitis. Chronic enlargements of the parotid occur but are more rare. The other salivary glands may likewise be involved simultaneously with, or independently of, the parotids.

Treatments.—Treatment of all these oral conditions, aside from those due to syphilis or cancer, consists primarily in the proper hygiene of the mouth and teeth. All patients who are confined to bed, particularly those with fever, should have the mouth and teeth cleaned after every feeding. For this purpose some simple antiseptic solution such as liquor antisepticus (diluted), carbolic solution (1 to 200 or weaker), or boric acid solution should be applied with the aid of absorbent cotton and an orange stick. If there is dryness, glycerin is useful in the form of boroglyceride, glycerin and lemon juice, etc. In pyorrhea the teeth should be freed from tartar by a dentist and the pus pockets frequently swabbed out with peroxide or tincture of iodine, or injected with emetin.

In stomatitis similar antiseptic solutions are useful

and in the mercurial variety chlorate of potash solution (2 per cent.) is very effective both for prevention and cure. Ulcers should be touched with the solid stick of nitrate of silver; this often has a magical effect.

Lead poisoning, syphilis, noma, and cancer require special treatment, in many instances operative.

DISEASES OF THE ESOPHAGUS.

Stricture and Tumor.—Inflammation of the esophagus or gullet does not usually give rise to any definite symptoms, or at the most to a little soreness beneath the sternum or to pain on swallowing. It is most common in alcoholic gastritis. Corrosive poisons, as a cause of inflammation, will be mentioned below. Dysphagia is the most common symptom referable to the esophagus. This may be due to the pressure of a growth outside the gullet, for example aneurysm. Occasionally an aneurysm ruptures into the esophagus with resulting hemorrhage and death. Sometimes small pockets, or diverticula opening out of the esophagus, become filled with liquid or semisolid food and cause obstruction by pressure. These diverticula are difficult to deal with, as they are not readily accessible to operation. Fortunately patients are usually able to empty them by pressing on the neck and are then able to swallow.

Stricture from narrowing of the esophagus itself is almost always due to one of four causes: (1) It may be due to *spasm* in nervous persons in whom it may be induced by excessive acidity of the stomach contents, etc. In these persons a stomach tube is frequently checked at the opening of the stomach, but if patience is used and the tube kept in place, the spasm after a time relaxes and permits the tube to enter the organ. These patients are frequently improved by the regular passage of sounds or tubes and by general medicinal and hygienic treatment. (2) So-called simple strictures of the esophagus are due

to contracting *scar tissue*, resulting from inflammation. Strictures are commonly found at the narrower parts of the esophagus opposite the larynx and at the entrance into the stomach. They result from the swallowing of corrosive liquids such as caustic soda or sulphuric acid, or from injuries inflicted by bones and other hard objects which have been swallowed. When caustic fluids have been swallowed the inflammation may be so violent as to lead to perforation, edema of the lungs, and even death before stricture develops. Simple stricture is treated by dilatation with sounds or occasionally by operation. (3) Stricture due to *syphilitic* ulceration is also a common variety. Much more rare are simple, tubercular, and typhoid ulcers. The diagnosis is made by the history and associated symptoms, or by the Wassermann reaction. Mercury and potassium iodide are of great use in this variety. (4) *Cancer of the esophagus* occurs either high or near the entrance of the gullet into the stomach. There is usually a varying degree of spasmodic obstruction in addition to the actual obstruction due to the tumor. This accounts for the improvement which is often seen from time to time in these patients. The malignant growths cannot often be successfully removed, but the patient may survive for a surprisingly long time without great discomfort. When the obstruction becomes considerable and emaciation is marked, an opening may be made through the abdomen directly into the stomach and a tube sewed in through which the patient may be nourished. This operation is known as *gastrostomy*.

Treatment.—The general treatment of esophageal obstruction consists in the administration of a concentrated, bland, and finely divided diet, including such articles as milk, purées made from milk, gruels, raw eggs, etc. Olive oil given prior to meals sometimes seems to act both as a demulcent to allay irritation and as a concentrated nutriment.

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Hemorrhage.—Hemorrhage from the esophagus, when it occurs, is commonly very profuse, being due, as a rule, either to rupture of an aneurysm or to esophageal piles. The latter occur in cirrhosis of the liver and will be referred to under that head. During life it is not always possible to say whether the blood comes from the esophagus or stomach.

CHAPTER II.

DISEASES OF THE STOMACH.

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| ORGANIC DISEASES OF THE STOMACH. | Pyloric Stenosis, Atony, and Dila- tation of the Stomach. |
| Acute Gastritis and Gastro-en- teritis. | Gastropptosis. |
| Chronic Gastritis. | FUNCTIONAL DISORDERS OF THE |
| Ulcer of the Stomach and of the Duodenum. | STOMACH. |
| Cancer of the Stomach. | Nervous Dyspepsia. |

DISEASES of the stomach may be organic or functional. In organic diseases there are distinct pathological alterations, such as inflammation, ulceration, malignant change, etc., which are the primary cause of the disturbed function. In the functional disorders as the result of nervous disturbances of various kinds, a great variety of symptoms develops without any corresponding organic basis. As the result of prolonged functional disturbances secondary organic changes may finally occur. In many cases dyspeptic symptoms are the expression of disease in distant organs—the lungs, heart, kidneys, etc. There is also a close interdependence between diseases of the stomach and diseases of other parts of the digestive canal—the intestines, liver, and pancreas.

ORGANIC DISEASES OF THE STOMACH.

Acute Gastritis and Gastro-enteritis.—Acute gastritis and gastro-enteritis are caused by overindulgence in food or drink (alcoholic beverages), by unsuitable or decomposed food, by infections, etc. A very intense and frequently fatal form of gastritis is due to corrosive and other poisons. The symptoms of gastritis are: loss of

appetite, nausea, vomiting of food and mucus, pain and tenderness in the pit of the stomach, and, if the intestines are also involved, general abdominal tenderness, colic, and diarrhea. In ordinary cases if food is withheld for a day and afterward a light diet is given, recovery is rapid. In the severer cases there may be excessive vomiting and purging, with fever and prostration. Symptoms of this character are frequent accompaniments of so-called "ptomaine" or food poisoning and may occasionally prove fatal. Ordinary acute gastritis in adults is almost always mild, but repeated attacks may lead to chronic gastritis. In children in whom the symptoms are usually due to unsuitable food, diarrhea is frequently present.

Treatment.—The treatment, as already indicated, is largely dietetic. Temporary starvation is often not amiss. In infants the food may be restricted to albumen or barley water; in older children and adults to gruel, broth, softened toast, skim milk, milk toast, rusks, arrow-root biscuits, and the like. In some cases, when the stomach is overloaded, an emetic may be administered, or better still, gastric lavage may be practised. In children it is usual to administer a laxative and, if necessary, to wash out the bowel. Bismuth and other local sedatives are useful to allay irritation in the stomach and to relieve diarrhea. In the more severe cases stimulation may be required.

Chronic Catarrh (*Chronic Gastric Catarrh*).—The term chronic gastritis (gaster—stomach) should be restricted to those cases in which evidences of inflammation or catarrhal change in the stomach are demonstrable; it should not be used as a synonym for chronic dyspepsia of all varieties. The majority of chronic dyspepsias are of nervous or reflex origin and true gastritis is relatively infrequent, a fact quite at variance with the common view. An amusing popular etymology derives gastritis from "gas" and makes it equivalent to flatulent dyspepsia. Chronic gastritis may occur as an independent or primary disease or it may be secondary to other diseases, particularly chronic heart, liver, and kidney disease. In these diseases

chronic passive congestion of the mucous membrane of the stomach is an important factor in causing the catarrhal condition. The most important causes of ordinary chronic gastritis are alcohol, improper food, and bad dietetic habits. Whisky, particularly when taken undiluted on an empty stomach, is the leading cause. Hot breads, pastry, fried foods, sweets, etc., doubly bad if unskillfully prepared, are doubtless important in the causation of gastritis. Ice-water, iced drinks, and ice-cream cannot be excused, though if taken with discretion, they may not be as harmful as they have been painted. Irregular meals, hasty eating, and insufficient chewing, seem to me to be of more importance than the character of the food. The abuse of drugs (*copaiba, e. g.*) and poisons of a locally irritating character are less usual causes. Ulceration and cancer of the stomach itself, as well as many of the functional states, may ultimately be complicated by a greater or less degree of gastritis.

The characteristics of gastritis are an increased secretion of mucus and a diminished secretion of hydrochloric acid and eventually of pepsin. At first there may be an irritative and excessive secretion of hydrochloric acid, while in advanced cases there is an absence of all secretions, even mucus, due to atrophy of the mucous membrane. The symptoms are loss of appetite, flabby tongue, belching, slight pain and general epigastric tenderness after meals, and constipation. In the severe cases nausea and vomiting of mucus, particularly in the morning, are the rule. Frequently the stomach loses tone and becomes moderately enlarged (atony).

Treatment.—The treatment consists of a careful restriction of diet and regularity in meals. The following food list, modified from one prepared by Dr. C. B. Worden for dispensary use, illustrates the general character of the diet for a mild case.

SOUPS: Consommé, bouillon, beef, chicken, mutton, oyster and clam broths, tomato, asparagus, pea and celery purées.

MEATS: Chicken, turkey, squab, broiled steak, roast beef, lamb, fish, oysters, sweetbreads.

EGGS: Lightly boiled, poached, raw.

VEGETABLES: Baked or mashed white potatoes, spinach, asparagus tips, cauliflower, green peas, lettuce, young lima beans, young string beans, stewed carrots, celery.

CEREALS: Rice, macaroni, oatmeal, hominy, wheat preparations.

BREADS: Stale wheat bread, toast, zwieback, pulled bread, rusks, crackers.

FATS: Butter, cream, grilled bacon, olive oil.

BEVERAGES: Milk, buttermilk, weak tea or coffee once a day, cocoa, water moderately at meals and freely between meals.

If the teeth are carious they should be repaired or artificial ones substituted. Lavage is often useful when there is much mucus. It should be given in the morning before breakfast and a teaspoonful of sodium bicarbonate should be added to each pint of warm water (105° F.) to facilitate the removal of the mucus. In other cases lavage with nitrate of silver solution (1 to 10,000 or stronger) may be used. Many patients get along nicely with hot water and alkaline powders taken before breakfast. The medicinal treatment consists of nux vomica and other bitters to promote appetite and secretions, dilute hydrochloric acid to supplement secretion, or alkalies (magnesia, chalk and sodium bicarbonate) to neutralize excessive acidity, and bismuth or nitrate of silver to diminish irritation. Pepsin and other ferments are not of much use, in spite of the popular prejudice in their favor.

Ulcer of the Stomach and of the Duodenum.—Ulcers of the stomach and of the duodenum are considered together, because in many cases it is impossible to determine clinically on which side of the pylorus an ulcer may be situated. Formerly ulcer of the stomach was considered to be much more frequent than ulcer of the duodenum, which was looked upon as more or less of a curiosity, but the experience of abdominal surgeons

has apparently demonstrated that ulcer of the duodenum is more common than ulcer of the stomach. Ulcer is common in middle-aged persons, but the symptoms are usually most clearly manifested in young persons.

Symptoms.—The cardinal symptoms of ulcer are pain, localized tenderness, hyperacidity of the gastric juice, and vomiting of blood. The time at which the pain develops depends largely on the situation of the ulcer.



FIG. 34.—Duodenal ulcer showing erosion of an artery in the base, from which fatal hemorrhage occurred: S, stomach; D, duodenum; A, artery; R, point of rupture. (Lockwood.)

If the ulcer is in the body of the stomach or near the cardiac end, that is, near the opening of the gullet, pain may develop very shortly after eating and may disappear when the stomach is empty. A sharply localized area of tenderness will be felt in the middle of the epigastrium or slightly to the left, and there may also be tenderness at the left of the lower spine (tenth dorsal). If the ulcer is near the pylorus, pain will develop later in the course of digestion as the stomach is emptying itself. In ulcer

of the duodenum a gnawing pain ("hunger pain") becomes manifest two, three or more hours after meals and is relieved by food. In many cases of duodenal ulcer there may be no distinct pain and the condition will only be recognized on the development of some threatening complication. When careful routine examinations are made, localized tenderness may be elicited, causing a diagnosis to be suspected.

Both in ulcer of the stomach and in ulcer of the duodenum, there is usually a decided hyperacidity; it is possible indeed that the excessive acidity of the stomach may precede the ulceration and be a factor in its causation.

Complications.—In typical cases of ulcer there is usually free hemorrhage or hematemesis, sometimes a pint or more. The vomited fluid is dark red, usually clotted, and sometimes mixed with gastric contents. The writer once saw a pint or more of clotted blood withdrawn through a stomach tube after a test meal. Fortunately this led to an immediate diagnosis of a hitherto unsuspected ulcer, and consequently to an operation (gastro-enterostomy), and the permanent cure of the patient. Hemorrhage, due to cirrhosis of liver, is in itself indistinguishable from that due to ulcer. In pulmonary hemorrhage the blood is bright red and frothy. In spite of its severity the hemorrhage in ulcer is seldom fatal, but is very liable to recur. If the ulcer is situated near the pylorus or in the duodenum no blood may be vomited, but black, tarry stools will be a feature of the case (melena). In many cases blood in the feces may be detected by delicate chemical tests ("occult" blood tests).

Perforation is particularly common in duodenal ulcer and it may occur in ulcer of the stomach. The symptoms of this accident are frequently the first evidences of digestive disturbance of which the patient is conscious. It is accompanied by intense pain, rigidity, and symptoms of collapse and requires immediate laparotomy. Many ulcers heal with the production of scar tissue. If this is

in the body of the stomach it may do no harm unless very extensive. Rarely a constriction may be produced forming the so-called "hour-glass" stomach. If the scar is at the pylorus or in the duodenum, stenosis results, with subsequent dilatation of the stomach. A case of this sort is referred to in the discussion on stenosis and dilatation.

Treatment.—The treatment of ulcer is either medical or surgical. Medical treatment consists in absolute rest in bed and relative starvation. The patient is nourished (?) for a number of days by nutritive enemata (*e. g.*, six ounces of peptonized milk and an egg every eight hours) and nothing is given by the mouth except, possibly, a little cracked ice. An ice-bag or warm compresses may be applied to the epigastrium. When the hemorrhage has ceased or subjective pain no longer occurs, a very light diet is gradually begun, at first consisting merely of milk, gruels, and beef preparations; later, eggs, and other semi-solid articles are added. After a few weeks the patient may take a diet such as has been recommended for chronic gastritis. He is allowed to sit up only when this no longer causes gastric distress.

Sometimes instead of adopting this routine the physician puts the patient on teaspoonful doses of iced milk or beaten white of egg administered at fifteen-minute intervals from the very beginning. The quantity of the food is gradually increased and the intervals of administration lengthened. This plan has the advantage of causing less anemia and loss of strength, and of avoiding the unpleasant rectal feeding. Convalescent ulcer cases usually require iron and other tonics. Milder cases are treated by the ambulant method with a light diet (principally milk, gruel, and eggs), bismuth subcarbonate in large doses, or nitrate of silver. Severe hemorrhage is treated by absolute rest, by the application of an ice-bag to the epigastrium, by the administering of morphin hypodermically as well as by adrenalin, and astringents internally. If bleeding recurs constantly, operation is

indicated. Gastro-enterostomy with or without excision of the ulcer is usually practised. Operation is also demanded in cases of perforation and stenosis with secondary dilation of the stomach.

Cancer of the Stomach.—Carcinoma is the only common form of tumor in the stomach, although sarcoma and benign tumors may occur. In a rather extensive experience I have seen only one case of each. Commonly the cancer is of the hard or scirrhus variety, but soft cauliflower-like growths are not rare. Sooner or later ulceration takes place in almost all cancers of the stomach with oozing of blood and discharge of pus. Free hemorrhage, so frequent in ulcer is rare, and blood when vomited has a dark appearance resembling coffee grounds. In the stools blood is present in minute amounts—"occult blood." The symptoms of the disease depend in part on the situation of the growth. A tumor at or near the esophageal opening sooner or later prevents the entrance of food into the stomach and gives rise to esophageal obstruction and starvation. A tumor at or near the pylorus ultimately causes obstruction at that orifice, retention and lactic-acid fermentation of the food, hypertrophy and dilatation of the stomach (visible gastric peristalsis), and vomiting. The visible peristaltic contractions represent an effort on the part of the musculature to overcome the resistance at the pylorus. They always pass from left to right and are seen even in normal stomachs by the *x*-rays. A tumor of the body of the stomach produces neither cardiac nor pyloric obstruction and proves fatal by the progress of the disease, by its extension beyond the confines of the stomach, etc. The general symptoms of cancer of the stomach are progressive wasting, loss of strength, and anemia ("cachexia"), with pain, tenderness, hemorrhage, and vomiting. To these may be added symptoms of metastasis (that is, the transfer of the disease through the blood) to other organs, and particularly to the liver, and the signs of perforative peritonitis.

The disease attacks persons in middle or advanced life, and, as a rule, there is no history of preceding dyspepsia, except in those cases which follow ulcer. In the latter there is a history of recurring attacks of painful indigestion, often with hemorrhage, varied by long periods of well-being. Heredity seems to be an important factor. Men are more frequently attacked than women. The disease is usually fatal within two years. The varieties which obstruct the orifices are the most rapidly fatal.

Examination of the stomach contents in most cases (except those preceded by ulcer) shows diminished or absent hydrochloric acid; in the pyloric cases there are retention and lactic-acid fermentation. The white cells of the blood are increased in carcinoma (leukocytosis).

Treatment.—If the tumor is at the cardiac end, obstruction finally gives the patient no choice between starvation and gastrostomy, *i. e.*, the formation of a new entrance into the stomach from the epigastrium. This operation is performed solely for the purpose of feeding the patient and serves only to prolong life for a brief period. At each feeding the rubber tube which has been fastened in the abdominal wall is connected to a funnel through which food is introduced. This must be finely divided. Sometimes the patient prepares his own food by chewing it and spitting it out. This is supposed to satisfy his hunger and to encourage the secretions of the stomach. In the pyloric cases gastro-enterostomy, or the formation of an opening between the stomach and intestine, may palliate the patient's condition in a similar manner. In early cases excision of part of the stomach may result in recovery. Aside from operation, treatment consists in a carefully selected diet similar to that used for chronic gastritis—lavage, bitters, and tonics, hydrochloric acid, etc. If there is obstruction the diet will need to be finely divided or semifluid, or nutritive enemata will be required, *e. g.*, 6 to 8 ounces of peptonized milk every eight hours. Salt solution by the bowel (Murphy method) is of great value in cases of obstruction and vomiting, to supply fluid to the

tissues. In bed-ridden cases care of the mouth and teeth and general attention to the skin will be of importance. Hemorrhage rarely requires special treatment. Perforation, heralded by sudden pain, rigidity, and collapse, will require immediate medical attention and probably laparotomy.

Pyloric Stenosis, Atony, and Dilatation of the Stomach.

—These three conditions are more or less interdependent; they may constitute distinct affections in themselves, but are usually secondary to other conditions. The stomach is essentially a muscular bag, with great differences in capacity according to demands made upon it. In hearty eaters and beer drinkers it may become greatly enlarged without losing its tone; this may be called hypertrophy of the stomach. In atony the stomach walls are relaxed so that the food is not discharged as rapidly as it should be. Air and other gases which are normally absorbed or rapidly passed on to the intestine or upward into the esophagus (normal eructation), collect in the stomach and cause distress and distention. Occasionally the gas may be derived from fermentation, but this is undoubtedly less common than popularly supposed. The carminatives probably act by stimulating the muscle of the stomach to reject the superfluous air. Simple atony may occur as an independent affection and is also an accompaniment of gastroptosis and of many forms of dyspepsia, particularly of the nervous variety.

If there is moderate obstruction at the pylorus there will be increase in muscular power to compensate for it and overcome it, and as a consequence the peristaltic movements will become distinctly visible. With increasing obstruction or stenosis the stomach will dilate to accommodate the retained food. Relief from excessive dilatation is obtained by periodic vomiting. The writer recently had a man under his care who had vomited almost daily for years. In this patient the stomach reached the symphysis pubis and enormous peristaltic waves could be seen passing slowly from left to right, like a

heavy "ground swell." In this case at operation an obstruction due to the scar of an old ulcer was found.

The principal causes of stenosis may be enumerated as follows: cancer of the pylorus, ulcer in the neighborhood of the pylorus with spasm or cicatricial contraction, adhesions due to gall-bladder disease, kinking due to displacement of the stomach (gastroptosis), and *congenital hypertrophic stenosis*. The latter is a rare affection seen in infants and due to thickening of the circular muscle at the pylorus. The principal symptoms are vomiting and rapid and usually fatal inanition. The causes of hypertrophy or dilatation of the stomach include the causes enumerated above, and in addition, simple atony, and enlargement due to overfilling.

Treatment.—The treatment of stenosis is usually operative. In the cases in which spasm of the pylorus occurs on account of irritation by acid contents or because of the presence of adjacent ulcers, or as a reflex from gall-stones or chronic appendicitis, relief may be obtained by treatment of the primary disorder, operative or otherwise. In dilatation, insofar as this is due to stenosis, the same remarks hold true to a large extent, nevertheless palliative treatment will often give a certain degree of relief and improve the chances of a subsequent operation. This



FIG. 35.—Habitus enteroproticus (p. 164). (Aaron.)

treatment consists in lavage, practised daily or oftener, and in the administration of finely divided and easily digested foods. Water may be administered by the bowel (continuous enteroclysis), as the amount that reaches the intestine by the normal route in these conditions is often small. In some cases rectal feeding is necessary, though this is never more than a temporary resource. In simple atony an effort may be made to stimulate the musculature of the stomach by large doses of *nux vomica* or strychnin, by the use of electricity and by douches against the spine and the epigastrium, or even into the stomach itself. In hyperacidity, alkalies, such as chalk, magnesia, and soda may relieve a spasmodic contraction of the pylorus.

Gastroptosis.—Splanchnoptosis is a term applied to downward displacement of the abdominal organs. Gastroptosis refers particularly to the stomach, but in most cases it is associated with "falling" of the kidneys, of the colon, and even of the liver. With these displacements there is usually associated a peculiar formation of the thorax, drooping shoulders, wing-like shoulder-blades, flat chest, and acute epigastric angle (*habitus enteroptoticus*). The conditions are thought by some to be congenital and by others to be the result of poor nutrition (rickets) in early childhood. Splanchnoptosis is not a disease in itself, but persons in whom it is found lack resistance and are prone to tuberculosis, neurasthenia, and digestive disturbances. Downward displacement of the stomach or of other organs may occur in persons of normal build, and particularly in women who have worked hard and borne many children in rapid succession.

In a case of gastroptosis, the abdomen is prominent below the umbilicus (Fig. 35), the walls are thin, and the muscles poorly developed. The stomach instead of occupying the normal area well above the umbilicus, assumes a more vertical position and extends to or below the umbilicus, sometimes even to the symphysis pubis. To diagnose the position of the stomach water is some-

times given, and the lower border of the stomach marked out by means of the splash. More commonly the stomach is dilated by pumping air in through a stomach tube, or

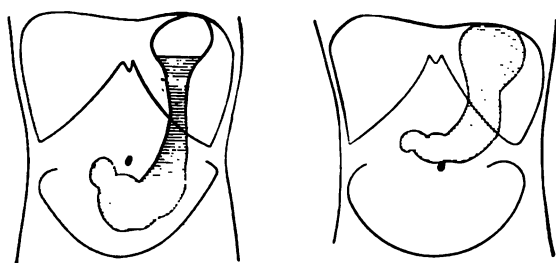


FIG. 36.—Position of stomach in ptosis as shown by the x-rays. Left, patient standing; right, patient reclining. In the vertical position the normal stomach occupies a position nearly identical with that shown on right. (Hertz.)

by distending with carbonic-acid gas (evolved in the organ after the administration of successive doses of tartaric acid and sodium bicarbonate). Under these conditions its position is evident to inspection or easily

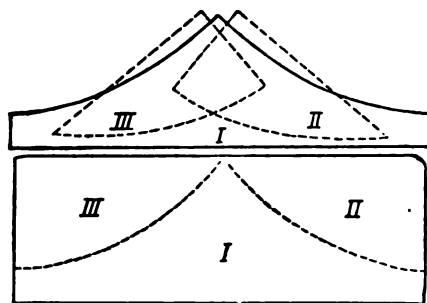


FIG. 37.—Rose's belt. (Lockwood.)

mapped out by percussion. The x-rays are the most satisfactory means of diagnosis; they are also valuable for locating the colon which is usually displaced in com-

mon with the stomach. Patients with gastrop-tosis may suffer no ill effects, but with loss of weight and lowered



FIG. 38.—Rose's belt as applied. (Lockwood.)

tone they frequently develop symptoms of atonic dyspepsia and complain of vague sensation of dragging, bearing down, etc. They are relieved when lying down.

Treatment.—The treatment of ptosis, *per se*, consists in improvement of the nutrition (S. Weir Mitchell rest cure), exercises to develop the abdominal muscles, specially fitted belts and corsets, and operations designed to suspend the stomach. The most satisfactory support for temporary use is the "Rose" adhesive-plaster belt, either in its original form or variously modified. Such a belt, renewed every three to six weeks according to the condition of the skin, may be worn for many months. A piece of zinc oxide plaster, preferably spread on moleskin, approximately one yard long and seven inches wide, is cut as shown in Fig. 37. The apex of the large piece (*I*) is fixed to the skin just above the pubis (shaved) while the ends are carried upward and backward around the body. During this manœuvre the abdomen is firmly supported in the desired position by the physician's hand placed over the plaster. The remaining strips (*II* and *III*) are reversed before being applied and serve to keep the soft parts from bulging at the sides. (Fig. 38.) The associated symptoms are treated as described elsewhere.

FUNCTIONAL DISORDERS OF THE STOMACH.

Functional disorders are usually traceable to general nervous disturbances (neurasthenia), local irritation, or reflex causes. In sensory neuroses the stomach is unusually responsive to painful sensations; heavy food or normal degrees of acidity will produce sensations of weight, burning, and distress (hyperesthesia) or intense paroxysmal pain may develop (gastralgia). Gastralgia may be a purely sensory phenomenon (rare) or it may be a manifestation of local irritation, as in ulcer, or of reflex dyspepsia, as in disease of the gall-bladder and appendix, or of disease in distant organs, as in locomotor ataxia (gastric crises).

The motor neuroses include excessive relaxation of the gastric musculature (atony) and undue muscular irritability. The former causes delayed expulsion of the

ingesta (retention). The latter is exemplified by nervous vomiting, nervous belching, and hypermotility. In nervous belching constant eructations occur quite independent of fermentation or atony. In hypermotility the food is hurried on into the intestines very soon after it is ingested. This may set up diarrhea, etc.

Secretory disturbances are the most frequent of all and include hyperacidity (hyperchlorhydria) in which an excess of hydrochloric acid is secreted, subacidity in which the secretion is diminished, and achylia in which the gastric juice is entirely deficient without obvious or adequate cause. Hyperacidity is usually associated with constipation and presents symptoms such as heart-burn and acid eructation, one-half to two or more hours after meals, often only at night. The patients are relieved temporarily by taking food, sodium bicarbonate, etc. In achylia with careful diet there may be no symptoms, but examination by the stomach tube shows that the stomach empties itself rapidly into the intestine. If coarse, or even slightly decomposed food is taken, abdominal distention and diarrhea readily occur because the food has not been broken up by digestion, nor the growth of harmful microorganisms prevented by the antiseptic action of hydrochloric acid.

Nervous Dyspepsia.—In nervous dyspepsia there is usually more or less derangement of all the functions of the stomach combined with the symptoms characteristic of mild neurasthenia. The symptoms are manifold and are described in great detail by the patients. The commonest gastric symptoms are belching, flatulence, nausea, heart-burn, fulness and distress (not severe pain or localized tenderness), and constipation.

Reflex or symptomatic dyspepsia is most frequently due to gall-stones, appendicitis, constipation, pulmonary tuberculosis, heart disease, Bright's disease, and pregnancy. Unless the physician is continually on his guard, he is liable to treat some grave organic disease as a trivial dyspepsia. Persons who treat themselves, including

nurses, are far more liable to fall into this serious and sometimes fatal error. Indigestion is often the first and only evident manifestation of nephritis and tuberculosis.

The treatment of motor neuroses has been discussed under Atony, etc. Sensory neuroses may be treated locally by sedatives, such as nitrate of silver and bismuth, and generally, by bromides, tonics, massage, baths, etc. Hyperacidity is treated by a bland diet free from coarse, acid, spicy, or even "tasty" foods. Excess of starch is to be avoided. Atropin is used to check secretion, and alkalies (sodium bicarbonate, powdered chalk, magnesia, and bismuth subcarbonate) to neutralize acidity. Sub-acidity and achylia are treated by dilute hydrochloric acid, which in the former case stimulates acid secretion and in the latter to some extent replaces it.

CHAPTER III.

DISEASES OF THE INTESTINES.

DIARRHEA AND ENTERITIS.

Infantile Diarrhea.

Diarrhea in Adults.

CHRONIC CONSTIPATION.

INTESTINAL OBSTRUCTION.

Hernia, Volvulus, and Intussusception.

INTESTINAL TUMORS.

STRICTURE OF THE RECTUM.

HEMORRHOIDS, FISSURES, AND FISTULAS.

APPENDICITIS AND DIVERTICULITIS.

Diarrhea and Enteritis.—Diarrhea is one of the commonest symptoms of intestinal derangement; it may be functional or dependent on organic changes in the intestines. Anxiety or other emotion, the stimulus of a heavy meal, or a sudden change in the weather may, any one of them, be the occasion of a mild diarrheal attack. The effect of cold, in the form of an ether spray directed against the abdomen, is sometimes utilized to relieve constipation, while the use of the woolen abdominal band for the prevention of diarrhea in babies and susceptible adults is familiar to all. Functional diarrhea may be due to toxemia. Typical examples are seen in uremia and in certain infectious diseases. The commonest cause of functional diarrhea is the ingestion of indigestible food. Prompt removal of the offending material by purgatives and enemas affords relief. An analogous form of diarrhea, sometimes acute and sometimes chronic, is dependent on gastric disease with absence of secretion and consequent imperfect preparation of the food for intestinal digestion.

Enteritis is a prolific cause of diarrhea; it may be catarrhal or ulcerative. The specific forms of ulceration, due to dysentery, typhoid, and tuberculosis are considered

elsewhere. Ulceration is a manifestation of severe enteritis and colitis in infancy and childhood; ulceration of the colon is also a common terminal condition in the aged or in the subjects of chronic disease. Enteritis is usually bacterial in origin but chemical (including toxic) agents may occasionally play a part. Passive congestion as seen in heart and lung disease is an important predisposing cause.

Enteritis is classified according to the portion of the bowel primarily involved; thus there may be duodenitis, enteritis, colitis, enterocolitis, proctitis, etc. Enteritis is used in a general sense and also specifically with reference to the small intestine. Duodenitis (inflammation of the duodenum) is supposed to be one of the causes of catarrhal jaundice (*q. v.*). In this form of enteritis as well as in inflammation of the small bowel generally, diarrhea may be absent. The terms colitis and proctitis are applied to inflammation of the colon and rectum respectively. Involvement of this portion of the intestinal tract is characterized by the passage of mucus and blood and sometimes by rectal tenesmus. Very frequently there is more or less general involvement of the whole gastro-intestinal tract (gastro-enteritis).

Infantile Diarrhea.—Diarrheal disturbances are much more frequent and serious in infants and children than in adults. In artificially fed infants the mortality from intestinal disturbances is extremely high, particularly during the summer months. In them the disease tends to recur and become subacute or chronic. The most frequent types of diarrhea in infants are: acute dyspeptic diarrhea, catarrhal enteritis, enterocolitis, and cholera infantum. Acute dyspeptic diarrhea is caused by the ingestion of coarse or otherwise unsuitable food (unripe fruit), and usually yields to enemas, purgation, lavage of the colon, or other measures, directed to the removal of the offending material. Enteritis and enterocolitis usually result from milk infection. In mild cases there is slight fever, colic and diarrhea. The stools are thin

and often offensive, and may contain undigested milk. They may be brownish in color, or more frequently green, and in aggravated cases in which diarrhea persists, mucus, blood and even pus make their appearance. The milder cases usually clear up permanently with the correction of the diet. The severe and neglected forms may become subacute or chronic, and are accompanied by emaciation and prostration. These cases are extremely difficult to feed, and relapse with the slightest change in the diet. The prognosis, except under the best hygienic conditions, is very dubious. Cholera infantum, fortunately a comparatively rare type of acute enteritis, is characterized by fever, vomiting, the passage of watery stools, rapid wasting, and early collapse.

Diarrhea in Adults.—In adults acute enteritis is less common, and is comparatively mild as a rule. The ordinary symptoms are colicky pains, abdominal soreness, and the frequent passage of semisolid or liquid stools. The discharge may contain mucus, but seldom any blood. Uncomplicated cases usually clear up in a few days. The severe fulminant form with vomiting, rice-water stools, excessive thirst, rapid emaciation, weak pulse, and subnormal temperature corresponds to cholera infantum and is known as cholera morbus.

Chronic diarrhea in adults is not uncommon. It may be due to specific infections, such as dysentery and tuberculosis, to toxemias such as uremia, to chronic inflammation and ulceration, to secretory disturbances in the stomach, to nervous influences, etc. Most of these causes are alluded to elsewhere. The symptoms in enteritis are not, as a rule, characteristic of the several underlying causes. The latter must be sought out by painstaking clinical and laboratory studies. In most varieties the stools are of a thin purée-like consistency and are passed without pain. In chronic dysentery there is tenesmus (painful straining) and the passage of mucus and blood. In mucous colitis there is an alteration of constipation and diarrhea (see Constipation). Emaciation

and anemia are features of most severe chronic diarrheas but are particularly marked in tuberculous enteritis.

Treatment of Diarrhea.—The treatment of diarrhea in adults consists in the removal of the cause when this is possible, in temporary abstinence, or in restriction of diet (see Gastro-enteritis), and in initial purgation. These measures are followed by antiseptics, astringents, local and general sedatives, etc. As examples of such drugs in common use may be mentioned salol, beta-naphthol, tannin, catechu, kino, chalk, bismuth, paregoric, and Dover's powder.

In infants similar drugs are of value, but opium must be used with caution or not at all. Intestinal lavage is often effective and is given by means of a catheter and a small funnel. The child should be placed on its back with the buttocks brought to the edge of the bed or table. The latter should be protected by a mackintosh, so arranged as to lead the fluid into a pail. The catheter should be introduced and then the flow of water started, after which it may be pushed in for eight to ten inches. The funnel should not be more than one or two feet above the level of the body, and a pint or more of fluid may be introduced at a time. As portions are expelled, usually with considerable force, washing is repeated, until the fluid returns clear. A variety of fluids may be used for the purpose, such as isotonic salt solution, boric-acid solution, a weak solution of nitrate of silver.

The diet demands the greatest care. In breast-fed infants, water may sometimes be given before nursing to dilute the milk, and abnormalities of this secretion may be corrected, if practicable, by attention to the diet and exercise of the mother. Diarrhea in breast-fed infants usually presents no serious difficulties. In artificially fed infants the dietetic treatment will depend entirely on what the child has been getting. Usually, milk should be withdrawn at least temporarily, and albumen water, sugar water or gruel substituted. Subsequently albumen (casein) milk, buttermilk, skim milk, whey, or simply pure milk, properly diluted or modified, may be employed.

PROPHYLACTIC VALUE OF PURE MILK.

The possible variations of diet are too numerous to allow of description, but stress should be laid on the importance for prophylaxis as well as for cure of a pure milk supply. In most of our large cities the local medical societies "certify" milk which meets their requirements as to purity and uniform composition. Certified milk is produced under the following conditions: The cows are tested annually with tuberculin to eliminate the danger of tuberculosis. They are kept in perfectly clean, well-lighted, airy stables, with proper food and fresh water. They are thoroughly cleaned before milking, and the milk is received in partially or completely covered pails, so as to avoid dust as far as possible. The milk is then immediately strained, passed over sterile coolers, bottled, and iced. It should be delivered within twenty-four hours. The milk is tested at regular intervals (weekly), to determine its uniform composition and freedom from bacterial contamination. Under such conditions milk is not sterile, but the bacteria are of harmless varieties, and very few in number (not over ten thousand to the cubic centimeter). Ordinary market milk, on the other hand, is usually produced under conditions which are far from hygienic. It is seldom kept cold, or protected from contamination, and in the summer, may contain countless bacteria (one million per c.c. or more), some of which may be injurious. The number of bacteria is, however, most important as an index of the care with which the milk has been handled. Certified milk is unfortunately too expensive for general consumption, although the poor may afford it temporarily in case of illness. An effort is being made to improve the general milk supply, so that it may approximate this high standard. Meanwhile commercial pasteurization is being demanded for all milk that does not meet the highest requirements. This process, if carefully performed, is usually effectual in destroying harmful bacteria, but it cannot be expected

to purify milk which is already badly contaminated, or to preserve it unless it is subsequently iced. The term "pasteurization" is applied to milk which has been heated sufficiently to destroy pathogenic bacteria, for example, to 150° F. (range 150° to 167°) for twenty minutes. When the milk supply is dubious or the temperature of the air high, domestic pasteurization can be practised with advantage. Complete sterilization necessitates heating the milk to the boiling-point for one-half hour on three successive days. Nearly sterile milk may be obtained by a single heating. In addition to these measures fresh, cool air and cleanly surroundings are of great importance in the treatment of intestinal disorder. The removal of an infant to the country or seashore may cure diarrhea which has persisted in the city in spite of the most careful attention.

Chronic Constipation.—The average healthy person has a regular formed evacuation of the bowels daily. Perfectly normal persons may, however, have two or perhaps more regular movements a day, or only one every two or three days. In constipation, on the other hand, movements occur at irregular intervals; the evacuations are usually increased in consistency; sometimes there is an alteration of constipation and diarrhea. Stools in constipation may assume peculiar forms, oftentimes appearing as small balls like sheep dung. Band or ribbon-like movements may occur in spasmodic constipation, but may also be suggestive of actual stricture, as from cancer. In mucous colitis constipation alternates with diarrhea, but the former is the dominant condition. A characteristic feature is the passage of large masses of mucus or cast-like formations with accompanying colic.

Under simple constipation we include only those cases which are seemingly independent of organic disease. Two forms are usually described—the atonic and the spasmodic. In one case the constipation is due to undue relaxation of the colon and lack of irritability of the rectum; in the other there is excessive irritability and

spasm, delaying the progress of the intestinal contents. The latter type occurs particularly in neurotic persons and is influenced by general treatment of the neurosis and by certain drugs which relax the spasm of the intestinal muscle, such as belladonna and hyoscyamus. These cases do not respond satisfactorily to the usual dietetic treatment, as the coarse food may actually irritate the bowel.

The causes of atonic constipation are very numerous and only the most important can be mentioned. As the result of modern "improved" methods of manufacture, many of our foodstuffs are offered in such a digestible form and so free from waste material, that there is little residue remaining to give bulk to the feces and to stimulate the peristaltic movements. It is believed that this lack of pabulum checks the growth of useful microorganisms, which normally constitute a very considerable bulk of the feces and secrete substances which stimulate peristalsis. For this reason Graham bread, rye bread, oatmeal, shredded wheat, green vegetables, root vegetables and fruits are often of value, since they furnish an excess of indigestible cellulose. Sometimes bran, variously prepared, agar-agar (or vegetable gelatin), liquid petrolatum, and other unabsorbable substances are administered with the same idea in view. The last-named substance differs from the rest in that it does not favor the growth of microorganisms. Aside from the foods which furnish "ballast," there are certain articles which are natural laxatives, in which may be included fats (including olive oil, butter, cream, etc.), the salts and acids of fruits and vegetables, spices, and condiments.

Another factor of even greater importance is habit. The mechanism of defecation is peculiarly susceptible to training, and is easily deranged by the slightest irregularity. Women are more apt to be negligent in this particular for trivial and insufficient causes than are men. The arrangement of the modern "closet" does not favor the most efficient use of the abdominal muscles. In defecation the normal crouching position is much

more effectual, as it makes the line of force more direct and favors the use of accessory muscles. Dr. Howard Kelly and others have suggested the use of a foot-stool to partially overcome this objection, as there is no likelihood of a return to primitive habits. This topic bears directly on the next cause of constipation, that is, impairment of muscular power, from maldevelopment (as in gastropptosis), from lack of exercise, from undue relaxation of the abdominal muscles following multiple pregnancies, and from injury to the rectal and perineal muscles in childbirth. Most of these causes are especially operative in women in whom constipation is so common as to be almost the rule. Here, again, there is much chance for improvement by exercises, particularly walking, rowing, and special abdominal movements, by the fattening or supportive treatment of ptosis, and by the repair of birth injuries. Not to multiply causes we may finally allude to the abuse of laxatives. The homeopathic physicians perhaps go too far in their distrust of purgatives, but there is no doubt that there would be less constipation if people paid more attention to diet and regularity, and did not resort immediately to drugs to secure relief from the fancied dangers of constipation. Many persons permit their minds to dwell upon the alleged harmful effects of constipation and do not allow the natural forces a chance to assert themselves. If the bowel is completely emptied by a laxative, there is no oncoming column of feces to excite the contraction of the rectum on the following day and one cannot expect the normal rhythm to be reestablished.

Treatment.—The curative treatment of constipation has been largely covered in the discussion of the causation. Simple enemas (soap and water) and suppositories (glycerin, gluten, or the home-made "soap stick"), are harmless methods of inducing an evacuation of the bowel if not too long continued. They should be used with the idea of establishing a regular habit (infants). In mucous colitis enemas consisting of olive or cottonseed oil are

valuable. One pint (more or less) of oil, warmed to blood heat, should be slowly injected by means of a rectal tube and a funnel, the patient meanwhile lying on the left side. If possible the oil should be retained for several hours or overnight. Drugs properly play little or no part except perhaps to tide the patient along until proper habits have been established. For this purpose cascara in some form is probably least objectionable. The palliative treatment includes a long list of laxatives too well known to enumerate in detail. The salines are particularly useful when it is the aim to withdraw fluid and to reduce local congestion as in heart disease, gall-bladder disease, and pelvic disease. Podophyllin and rhubarb are supposed to act especially well on the upper bowel and aloes on the lower. Senna (compound licorice powder) is particularly useful in piles as it makes the movements soft but not loose. The more drastic purgatives such as compound cathartic pills and the like are only justifiable in aggravated cases.

Intestinal Obstruction.—Obstruction of the bowels is a very serious and often fatal condition which may at times be mistaken for obstinate constipation. The distinction is very important, since purgatives which are indicated in constipation, may be extremely dangerous in obstruction. In obstruction the lumen of the bowel is shut off, from one cause or another, so that the contents cannot pass; in acute obstruction, there is usually in addition strangulation, *i. e.*, cutting off of the blood supply. Chronic obstruction develops insidiously, and is usually due to tumors, benign strictures (following ulceration), and peritoneal adhesions. Acute obstruction may be due to these causes, but more frequently results from strangulated hernia, volvulus, or intussusception.

Hernia, Volvulus, and Intussusception.—Hernia may be either external or internal. A portion of the bowel is caught either in one of the external "rings" or in one of the many normal or abnormal pockets or slits in the peritoneum which invite such an accident. At the point of stricture the circulation is usually interfered with, so that

the loops of bowel which have been caught, become swollen, congested, inflamed, or gangrenous. Hernia may occur at any age. Another cause of intestinal obstruction is volvulus. This signifies a twisting or rotation of the intestines, with consequent obstruction to its lumen or blood supply. I have recently seen a case in which the greater part of the small intestine was tied in a complicated knot, causing obstruction, gangrene, and death. Volvulus occurs chiefly in the aged. In infants and young children the most important cause of obstruction is intussusception. In this condition, which is probably the result of spasmodic contraction, one part of the bowel

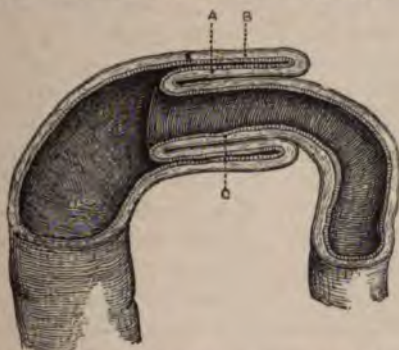


FIG. 39.—Intussusception. (Park.)

above becomes telescoped into the part below, like a glove finger which has been partially turned inside out. This produces a "sausage-like" tumor. Intussusception is most common where the ileum joins the ascending colon.

Symptoms.—The symptoms of obstruction are those of severe prostration or collapse with vomiting, constipation, paroxysmal pain, rigidity, distention, and visible peristalsis. If the obstruction is high up the vomiting is frequently fecal. The constipation is usually complete, but there may be small movements or discharges of blood and mucus. The position and direction of the peristaltic movements sometimes indicate the site of

obstruction. The rapidity of development and severity of the symptoms depend on the situation and completeness of obstruction. Obstruction high up is more rapidly fatal than that low down.

In rare instances the symptoms of obstruction may be due to a functional spasm—dynamic obstruction. Such cases may be promptly relieved by a large dose of atropin administered hypodermically. In obstruction due to external hernia or to a low-lying intussusception, if the patient is seen early in the disease, the bowel may sometimes be reduced by manipulation. In the majority of cases obstruction “spells” immediate operation. If the strangulation has existed for a short time only it may be sufficient to relieve the obstruction, but if the vitality of the tissues has been impaired, a portion of the intestine may have to be resected. The medical treatment, preliminary to operation, consists in the use of enemas, lavage of the stomach, and other measures designed to relieve distress or to clarify the diagnosis.

In this connection, we may mention another comparatively rare condition which presents similar symptoms—embolism or thrombosis of one of the larger abdominal arteries or veins. The blocking of one of the mesenteric vessels causes intense, agonizing pain, distention, and other symptoms suggestive of obstruction. As a result of interference with the circulation a large section of the bowel may become gangrenous.

Intestinal Tumors.—Many forms of tumor occur in the intestines, but we shall limit our attention to the commonest, which is cancer. This generally leads to chronic intestinal obstruction and its accompanying symptoms. In addition there are the usual symptoms of cancerous invasion—loss of weight and strength, progressive anemia, and pain of varying degree depending on the part affected. Any portion of the intestines may be attacked by carcinoma, but the usual sites are the ascending colon, the sigmoid, and the rectum. In the latter situation the obstruction may be felt on rectal examination. In cancer

Of the colon and sigmoid a distinct tumor is usually palpable; the gut above the tumor is often thickened and spastic and peristaltic waves may be seen passing in the direction of the obstruction. This hypertrophy is compensatory and is "designed" to force the fecal material through the strictured intestine. The stools are sometimes ribbon- or pencil-shaped, but this appearance may be produced by simple spasmodic constipation. Other symptoms are the passage of mucus, pus, or blood. If the tumor is low down, these may often be detected in the stools by the naked eye, otherwise only by microscopic examination.

Treatment.—The treatment of cancer, when an early diagnosis has been made, is operative—excision of the growth. In advanced cases palliative measures are alone indicated. These may include operations, *e. g.*, the formation of an artificial anus. Sometimes it is possible to short-circuit the bowel and avoid the obstruction, with or without removal of the growth. The medical treatment consists merely in ordering food that will leave as little residue as possible and in attending to the comfort of the invalid.

STRICTURE OF THE RECTUM.

Syphilitic stricture of the rectum is relatively common, and produces local symptoms not altogether unlike those of carcinoma. The general cachexia is, however, lacking and the history and symptoms of syphilis distinguish the affection. The Wassermann reaction affords an almost certain indication of the character of the disease, when it is otherwise in doubt.

Hemorrhoids, Fissures, and Fistulas.—Hemorrhoids or piles are produced by the enlargement of the small veins in the rectal walls just above or below the sphincter. In the latter case they are known as external hemorrhoids, in the former as internal hemorrhoids. They are really the same as varicose veins, and are produced by causes which promote local congestion; constipation, chronic

liver disease, and chronic heart disease. In internal hemorrhoids the most prominent symptom is hemorrhage which may be persistent and lead to intense anemia. Occasionally the piles may be caught in the sphincter and strangulated, with the production of great pain. External hemorrhoids appear as irregular tags or ears about the anal opening. From time to time they become inflamed and painful. Not infrequently these tags become distended with large blood clots. They then appear as red, rounded, and extremely tender lumps, like cherries. If an attempt is made to reduce them into the rectum, on the mistaken supposition that they are prolapsed internal hemorrhoids, the pain is aggravated.

Hemorrhoids are treated by soothing or astringent ointments or suppositories, by attention to the bowels to prevent constipation or diarrhea, and by local applications of cold. Cleanliness is of great importance. When hemorrhoids do not yield to palliative measures, operation is demanded. For external hemorrhoids it may suffice to incise or turn out clots, but the usual treatment of hemorrhoids consists in removal by ligation, cauterization, or excision.

Fissures are narrow, linear ulcers in the region of the rectal sphincter which either complicate hemorrhoids or arise independently. They cause intense pain and slight bleeding with every movement of the bowels. They are usually cured by stretching of the sphincter muscle to prevent spasm or by touching with lunar caustic.

Fistulas are deep sinuses at the side of the rectum, which result from abscesses in this region (ischio-rectal). They usually require operation, which consists in slitting up the sinus and packing with gauze. They are common in tuberculous subjects.

Appendicitis.—Inflammation of the appendix presents very distinctive symptoms which call for separate consideration. The appendix is situated at the tip of the cecum, and in certain lower animals (herbivora) is of considerable size and of much importance in digestion. In man it is apparently a relic, and like other unused

organs, particularly liable to disease. The appendix contains a large proportion of lymphoid tissue, similar to that of the tonsils, and like that of low vitality and peculiarly liable to infection. The blood supply is variable and sometimes inadequate. The lumen of the organ is often narrowed or obliterated by adhesions, by kinking, by repeated attacks of inflammation, or by the lodgment of foreign bodies. If, as is usual, the obstruction is near the cecum this interferes with drainage and in case of inflammation impedes or prevents the discharge of inflammatory products. These and other conditions favor the frequent development of bacterial infections. The colon bacillus and the streptococcus are the common infecting organisms, the latter being the more dangerous.

Inflammation of the appendix may be acute or chronic. The acute forms are the catarrhal, suppurative, gangrenous, and perforative. The chronic varieties are the catarrhal and the obliterative. Catarrhal appendicitis tends to recovery and subsequent relapse. Suppurative appendicitis frequently involves the peritoneal covering and leads to local adhesions, abscess, or general peritonitis. In the gangrenous form the appendix often perforates or sloughs off and sets up general peritonitis before limiting adhesions have had time to form.

Symptoms.—The chief symptoms of acute appendicitis are pain, tenderness, and rigidity. The pain may at first be general over the whole abdomen, but later will become localized in the right side of the lower abdomen. Occasionally it may be referred to the back or other situations. The tenderness is usually sharply localized at McBurney's point, below and to the right of the navel. The muscles of the affected side are rigid, and if an abscess has formed, a mass may be felt. There is moderate fever, the pulse is rapid, and the white blood cells, if counted, are found to be increased. The bowels are usually constipated rather than loose. An acute attack of appendicitis may subside in a few days, but there is usually some slight tenderness over the appendix remaining, and attacks tend to recur at irregular intervals. At other

times instead of clearing up, perforation and abscess formation occur, and if the patient is "unoperated," death will follow from peritonitis. In chronic appendicitis there is usually persistent, though slight, tenderness over the appendix, and the thick and hardened organ can at times be felt through the abdominal wall. Chronic appendicitis is less likely than acute to give rise to abdominal complications, but is a common cause of chronic functional dyspepsia.

Treatment.—The treatment of appendicitis is usually by operation. Mild cases frequently recover without resort to this measure, but recurrences are so likely to take place and may be so dangerous to life, that operation is almost always called for. The operation in uncomplicated cases consists in the removal of the appendix (appendectomy). If an abscess has formed it must be drained, while if general peritonitis has developed free drainage of the peritoneal cavity is necessary. In chronic appendicitis the necessity of operation will be largely determined by the severity of the dyspeptic symptoms. The medical treatment of acute appendicitis is usually confined to rest in bed, fasting, or strict limitation of diet, cold local applications, low enemata, and enteroclysis. Purgatives are contra-indicated.

Diverticulitis.—Diverticulitis is a name applied to a somewhat rare inflammatory process, involving certain pouch-like appendages of the small or large intestine. Near the end of the ileum a finger-like diverticulum (Meckel's) is occasionally found which bears some resemblance to the appendix, but is considerably larger. This is due to the abnormal persistence of a structure normal in prenatal life. Other thimble-shaped protrusions are found in the course of the large intestine, most frequently on the left side. The symptoms of diverticulitis are similar to those of appendicitis but the pain, etc., is often on the left side. I recently performed autopsies on two cases illustrating these types, occurring within a few weeks of each other and in the same hospital. The treatment of the affection is surgical.

CHAPTER IV.

DISEASES OF THE PANCREAS, LIVER, BILE PASSAGES, AND PERITONEUM.

| | |
|--------------------------------|---------------------------------------|
| DISEASES OF THE PANCREAS. | Cancer of the Liver and Gall-bladder. |
| Pancreatitis. | Congestion of the Liver. |
| DISEASES OF THE LIVER AND BILE | DISEASES OF THE PERITONEUM. |
| PASSAGES. | Ascites. |
| Jaundice. | Peritonitis. |
| Gall-stone Disease. | Tumors. |
| Cirrhosis of the Liver. | |
| Abscess of the Liver. | |

DISEASES OF THE PANCREAS.

Pancreatitis.—Diseases of the pancreas are difficult of recognition because of their rarity, the deep-seated situation of the organ, and the similarity of the symptoms to those produced by disease of neighboring structures in the upper abdomen. They bear a close relation to gall-bladder disease because the bile and the pancreatic juice empty into the bowel by a common opening. Obstruction of this duct by tumor or gall-stones may cause chronic pancreatitis, a condition often recognized by surgeons at the operating table. The presence of chronic pancreatitis is suggested by an excess of fat and undigested meat in the stools, due to the exclusion of the pancreatic juice from the intestines. Bile or infectious material may also gain access to the pancreas, particularly in cases with obstruction, and thus initiate an acute hemorrhagic, suppurative, or gangrenous pancreatitis. Acute pancreatitis is characterized by sudden agonizing pain in the pit of the stomach, vomiting, and collapse. Death may occur in a few hours, or a few days. In less

acute cases there is a coincident peritonitis. Obstruction of the bowel or perforation of a gastric or duodenal ulcer is usually suspected. At operation or autopsy, extensive hemorrhage into the pancreas is found, with fat-necrosis (destruction) throughout the abdomen, due to the escape of the powerful digestive (fat-splitting) secretion of the pancreas. In other cases there is gangrene or abscess formation. Occasionally cases are saved by early operation. Cancers, cysts, and other tumors, as well as stone may occur in the pancreas.

DISEASES OF THE LIVER AND BILE PASSAGES.

Jaundice.—Jaundice is a symptom common to many disturbances and diseases of the liver, such as congestion, cirrhosis, cancer, and gall-stone disease. In jaundice the skin, the whites of the eyes, the roof of the mouth, etc., take on a yellowish color which may vary from a scarcely perceptible lemon tinge to a deep olive hue. Even the serum of the blood is bile-stained. In negroes, and to a less extent in "whites" care must be taken not to mistake brownish-yellow deposits of fat in the sclera for jaundice. The brown "liver spots" (chloasma), so commonly seen on the face, are quite distinct from jaundice, though it is possible that in some cases they may be due to defective action of the liver. Jaundice is frequently accompanied by severe itching. The pulse is usually slow and there is an unusual liability to hemorrhage (tendency to bruising and purpura). In pronounced cases nervous symptoms not unlike uremia may develop (cholemia). In obstructive jaundice, the bile cannot reach the intestines and the stools are of a white, clay color. The urine, on the other hand, is deeply pigmented (orange-yellow). In non-obstructive or toxic jaundice, the stools may be of normal color, or deeply bile-stained.

Causes.—Jaundice is common in the newborn and usually is not of serious significance; occasionally it may be a manifestation of septic infection. Septic or toxic

jaundice may also occur in adults (most often, it is said, in butchers), but it is rare. It is not an uncommon complication of pneumonia and in some epidemics, a large proportion of the patients are thus affected. Catarrhal jaundice is a common affection in young people. It is commonly associated with acute duodenal catarrh, or occasionally with a general gastro-enteritis (vomiting, diarrhea, etc.). The congestion and swelling of the mucous membrane of the duodenum probably accounts for the temporary closure of the orifice of the bile duct in these cases. In the beginning there may be slight fever, malaise, coated tongue, epigastric distress, but by the time the jaundice is fully developed the patient may feel perfectly well. Clay-colored stools and other evidences of obstruction are present. The jaundice usually lasts for several weeks or even months, but in the latter case some more serious disease should be suspected. Acute yellow atrophy is a rare and rapidly fatal disease characterized by increasing jaundice, vomiting, delirium and other toxic symptoms. Accompanying it there are hemorrhages into the skin and from all the mucous membranes. Fever is slight or absent. At autopsy the liver is small and fatty.

Gall-stone Disease.—Gall-stone disease (cholelithiasis) is an extremely common condition in middle-aged persons and in those inclined to obesity ("fat and forty"). It is more common in women than in men. It is probably favored by lack of exercise (sedentary habits) and may frequently follow infection, particularly typhoid fever. Gall-stones are usually accompanied or preceded by inflammation of the gall-bladder (cholecystitis). The stones themselves consist of an accumulation of bile about some central nucleus, but may occasionally be covered with a rough whitish deposit of lime salts. They are more frequently of an olive or brown color, and may be solitary or multiple (from two or three to several hundred). In the latter case they are often nicely faceted, so that they fit closely together and frequently completely fill

the gall-bladder. If they remain undisturbed in the gall-bladder there may be no symptoms, or merely slight dyspeptic disturbances. Reflex gastric symptoms, however, may be severe, particularly when there are large, rough stones which cannot escape. These excite inflammation, local adhesions, or reflex spasm of the pylorus. The symptoms are those of hyperacidity and retention. Several hours after food (at night) intense distress, heart-burn, and water-brash supervene. The patient gains relief by vomiting or by taking sodium bicarbonate. With these symptoms there is usually tenderness over the gall-bladder and in the back (at the right of tenth or eleventh vertebral spine). Smaller stones are prone to escape from the gall-bladder through the ducts into the intestines, exciting in their passage intense paroxysmal or colicky pains. These pains are referred to the gall-bladder region and pass around the chest and up to the right shoulder. The stone is usually delayed more or less in the common duct and may be permanently impacted, leading to slight temporary, or severe permanent jaundice with the usual associated symptoms. Sometimes a stone acts like a ball-valve and causes intermittent jaundice. In other cases suppurative conditions of the bile passages or fistulous openings into neighboring organs occur. These complications are often accompanied by fever, sweats and chills.

Treatment.—Gall-stone dyspepsia may be treated on the same principles as gastric hyperacidity (*q. v.*) with the addition of special measures, such as the administration of sodium phosphate or Carlsbad salt. If the symptoms are at all severe and persistent, operation affords the best prospect of permanent relief. Gall-stone colic is treated by the hypodermic administration of morphin and atropin, by local hot applications, etc. If the stone becomes impacted, early operation is advisable to prevent complications. In cases with recurrent gall-stone colic, operation is also indicated. Opening of the gall-bladder (with drainage) is known as cholecystotomy; its removal as

cholecystectomy. In choledochotomy the common bile duct is opened for the purpose of drainage or for the removal of stones.

Cirrhosis of the Liver.—Atrophic cirrhosis is described in popular parlance as “hardening of the liver.” This is a more apt designation than the accepted medical term since the liver is not always either small or distinctly

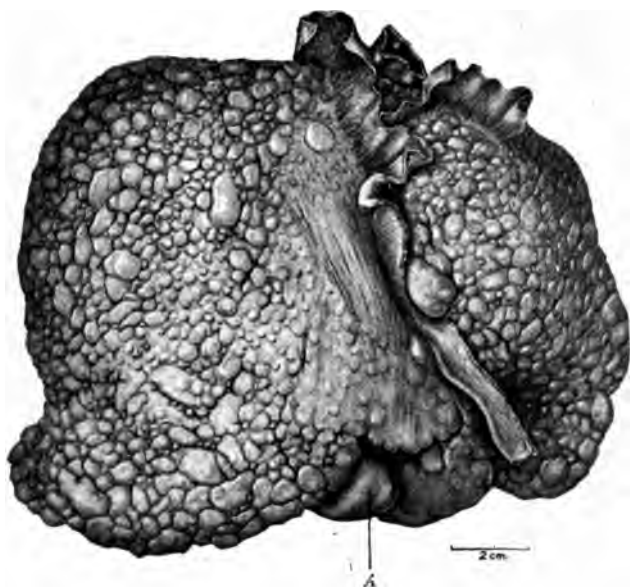


FIG. 40.—Liver, advanced cirrhosis; typical hob-nailed organ.
A, gall-bladder. (Hare.)

yellow (cirrhosis means yellow) in this disease. “Gin-drinker’s liver” is also a good old term that is still applicable if gin is understood to mean whisky. There are many forms of cirrhosis, but only two or three are of common occurrence, to wit: The alcoholic (portal) type and its varieties, and the syphilitic type. The former type includes fatty cirrhosis in which the liver is large and

fatty as well as rough and hard. This is seen in immoderate beer drinkers (Münich liver) and occasionally in chronic tubercular patients. Much more common is the so-called atrophic type which is seen in those who indulge in spirits to excess. In this type the liver is either large (early) or small (in the advanced stage), yellowish in color, and very hard and firm. The surface is covered with small granules or "hob-nails." (Fig. 40.) The spleen is usually enlarged, and, owing to the interference with the circulation through the liver (portal vein and its branches), the abdominal veins are distended with blood. This causes hemorrhoids, esophageal piles, enlargement of the collateral veins on the surface of the abdomen, and as a consequence of these conditions, rectal hemorrhage, vomiting of blood, ascites, etc. In syphilitic cirrhosis the liver is even more distorted and irregular, but the chief distinction is in the etiology. True hypertrophic cirrhosis is a comparatively rare disease. It is accompanied by severe jaundice and cannot usually be traced either to alcohol or syphilis. The description which follows applies only to the common portal or alcoholic cirrhosis.

Symptoms.—The symptoms of cirrhosis develop so gradually that the diagnosis can at first be suspected only from the habits of the patient. The onset of this disease is usually preceded by a more or less prolonged history of chronic gastritis with its typical symptoms—vomiting of mucus in the morning, anorexia, diffuse epigastric distress, and bowel disturbances. Frequently there will be a history of intercurrent attacks of acute gastroenteritis with vomiting, diarrhea, and sometimes jaundice. At this stage the liver may be easily felt and is somewhat tender. The diagnosis of the disease is not usually certain, however, until the typical association of anemia, ascites, and hemorrhages from the stomach (ruptured esophageal piles) settles the nature of the case. There may be slight jaundice revealed by the muddy tinge of the conjunctiva. More often the whites of the eyes are unusually white and shiny. With radical change

of habits the disease may be checked in the early stages, and even after the development of ascites marked improvement is possible, but usually the course is steadily downward. In the later stages of the disease the liver may become so small that it is no longer palpable, but this is by no means invariable. After tapping for ascites has been instituted, it must usually be repeated at frequent intervals. In the majority of cases the patient does not long survive, but occasionally, after a large number of tapplings, the ascites may disappear and the patient may recover a moderate degree of health. This favorable outcome always suggests that the disease may be largely a chronic peritonitis, but in some cases improvement is due to vascular adhesions, with the development of adequate collateral branches which relieve the circulation through the diseased organ.

Prognosis.—The prognosis of cirrhosis of the liver after typical symptoms have once developed is not hopeful. Life is rarely prolonged more than two or three years. At the present time certain functional tests are being tried out which may make an earlier diagnosis, hence a more favorable prognosis, possible. One of these tests is concerned with the ability of the liver to take care of (metabolize) certain sugars, another is similar in principle to the phenolsulphonephthalein test in kidney disease.

Treatment.—Syphilitic cases should be treated in accordance with the principles laid down elsewhere. In ordinary alcoholic cirrhosis, alcohol should be forbidden, and a bland diet suitable for chronic gastritis should be ordered. Purgatives and diuretics may be prescribed to prevent or remove accumulation of fluid. If there is much fluid in the abdomen, it should be removed by tapping with a trocar (see Ascites). Operative treatment (Talma's operation, etc.) consists in opening the abdomen, removing the fluid, and afterward attempting to establish a collateral circulation between the omentum or liver and the abdominal wall, with the purpose of relieving

believed, especially with respect to the latter. This method is generally successful.

Disease of the Liver.—Various diseases of the liver and its passage (suppurative cholangitis) may occur in general systemic disease with obstruction and infection, or suppurative appendicitis, and in other abdominal



FIG. 46.—Case of enormous ascites due to atrophic hepatic cirrhosis.
(Hare.)

and inflammations. The condition is accompanied by fever, anorexia, and chills, and manifestations of pyemia, and is almost invariably fatal. Solitary abscess of the liver is usually a sequence of dysentery, and will be referred to again in the consideration of the latter disease. These abscesses may be of considerable size, and are frequently cured by incision and drainage.

Cancer of the Liver and Gall-bladder.—Cancer of the liver may be primary, but is usually a sequence of cancer in other localities, most frequently in the stomach or colon. The site of the primary disease is frequently obscure during life. The chief symptoms are persistent and increasing jaundice, an irregular tender liver, ascites and cachexia (anemia, emaciation, and weakness). The disease is progressive and is not amenable to treatment. Exploratory operation is at times justifiable to exclude even the remote possibility of gall-stone disease, since the latter can usually be relieved by operative measures. Cancer may also begin in the gall-bladder and later extend to the liver. This variety is frequent in those who have suffered from neglected gall-stone disease.

Congestion of the Liver.—Passive congestion of the liver is due to failure of the circulation and the damming back of the blood into that organ. This is a symptom of heart disease, with loss of compensation. The liver is enlarged and pulsating. It is felt, however, to be perfectly smooth, and returns to approximately normal size with the relief of the causal condition. Acute congestion with slight swelling and tenderness may occur in so-called bilious attacks, catarrhal jaundice, etc. This condition is usually relieved by correction of the diet and laxatives.

DISEASES OF THE PERITONEUM.

Ascites.—Ascites is a term applied to an effusion of fluid into the peritoneal cavity. If the amount of the fluid is at all large the abdomen bulges in the flanks, while the intestines are floated forward. On examination the physician will find dulness which is movable with change of position, and a wave or fluctuation which is transmitted through the fluid from one side of the abdomen to the other. When the physician is attempting to elicit the latter symptom, he will usually ask the nurse to rest the ulnar side of her hand on the middle line of the abdomen. This is to prevent the transmission of a deceptive wave

have seen cases in which it was very difficult during life to distinguish cancer from cirrhosis with ascites. Sarcomatous tumors may originate behind the peritoneum and push forward into the abdomen. They often attain a great size and are spoken of as retroperitoneal growths. Unlike cancer they may occur in young adults and even children. In a case recently under observation the patient, a young man of twenty-seven, complained of nocturnal attacks of intense pain in the epigastrium which were of recent onset. The other findings—abdominal tenderness, hyperacidity, and blood in the stools—suggested the possibility of duodenal ulcer. At operation a sarcoma was found at the right of the spinal column. This had undoubtedly involved some of the spinal nerves and had given rise to the deceptive pains.

PART VI.

DISEASES OF METABOLISM.

GENERAL CONSIDERATIONS.

Principles of Metabolism.

Food Values.

DISEASES OF METABOLISM.

Obesity.

Inanition and Malnutrition.

Diabetes Mellitus.

Diabetes Insipidus.

Gout.

Rickets.

Scurvy.

Osteomalacia.

Beriberi.

Pellagra.

General Considerations.—Principles of Metabolism.—

Metabolism ("change") is the name applied to all those complicated physical and chemical processes occurring within the living body, by means of which heat and energy are liberated, and nutriment is assimilated and built up into living structures, or on the other hand, effete tissues and waste products are broken down and excreted from the body. The term is not applicable to changes in the food which occur in the stomach and intestine before absorption, or to alterations in the secretions and excretions after they have escaped from the glands of the skin, kidney and gastro-intestinal tract, or from the alveolar epithelium of the lung.

The principal substances with which we have to do in the study of metabolism are the proteins, the hydrocarbons or fats, the carbohydrates (sugars and starches), water, salts, and oxygen. In addition substances known as vitamins, which seem to be essential to health or even to life, are found in minute amounts in a normal diet. The absence of certain specific vitamins is the cause of beriberi, scurvy, and possibly of pellagra and other diseases. With the exception of oxygen which we absorb

from the air through the lungs, all these substances are found in the food. Protein is ingested in the form of meat, the casein of milk and cheese, the gluten of wheat, etc. Protein compounds are characterized by the fact that they all contain nitrogen. They are an essential constituent of all the organs and tissues. An excess of protein in the food beyond that required for the repair of the tissues is used for the production of heat and energy. The daily requirement of protein may be illustrated by an example. A man of seventy kilos, or one hundred and fifty pounds, at ordinary work, will require from sixty to one hundred and fifty grams (two to five ounces) per day. Ordinarily one hundred grams (three and one-third ounces) give a safe margin.

The fats are either stored up in the body (adipose tissue) as a reserve or oxidized (in familiar language, "burnt up") with the production of heat and muscular energy. A man of the weight previously mentioned will require fifty to one hundred and fifty grams of fat, ninety grams (three ounces) being an average amount.

The carbohydrates, which include the closely related sugars and starches, under ordinary conditions furnish the greater proportion of the heat and energy required by the organism. A plentiful supply of fat and carbohydrate (carbonaceous food) is required by those who undertake severe physical labor. This is quite in opposition to the popular idea that meat in large quantities is essential to those doing laborious work. Our hypothetical man will require from three hundred to six hundred grams of carbohydrate daily; four hundred grams (thirteen and one-half ounces) is an average amount. Water constitutes nearly 90 per cent. of the human body, so that a liberal supply is obviously essential. It must be remembered, however, that most of our solid foods contain a large proportion of water. The figures which have been given refer to the dry weight of the foodstuffs. The salts include such substances as common salt, which in dilute solution (physiological) bathes all the tissues, calcium phosphate, to which the firmness and rigidity of

the bony structures are due, and iron, which is a constituent of the red blood cells. Oxygen, which is absorbed through the lungs, is an essential agent in the chemical changes which take place in living matter.

The waste products of nitrogenous or protein metabolism are excreted in the urine in the form of urea, uric acid, etc. Part of the protein, and practically all of the fat and carbohydrate are "burnt up" and excreted from the lungs as carbon dioxide. Under pathological conditions sugars and fats may not be completely broken down, and then they appear in the urine as glucose, acetone, etc.

Food Values.—When food is "burnt up" or oxidized in the body a definite amount of heat (or energy) is developed, which may be estimated quantitatively just as in the case of an engine consuming coal or gasoline. It is a familiar fact of physics that energy may be expressed in equivalent terms, either as work, electrical energy, heat, etc. We might express the energy of food by means of foot-pounds, or horsepower, but it is more convenient to make use of the equivalent heat units or calories. A "large" calorie is an arbitrary unit denoting the amount of heat necessary to raise one liter of water one degree C. (from 0° to 1°). The caloric value of the various food products is determined by burning them in a special apparatus. For ordinary purposes, however, we calculate the caloric values from the chemical composition by means of certain factors which have been corrected to adapt them to the conditions found in the human economy. These factors in round numbers are as follows: protein, four; fat, nine; carbohydrate, four.

The method of calculation is shown by the following example: One liter (one quart) of milk contains 40 grams of fat, 35 grams of protein, and 45 grams of milk-sugar, hence:

$$\begin{array}{rcl} 40 \times 9 & = & 360 \text{ calories.} \\ 35 \times 4 & = & 140 \quad " \\ 45 \times 4 & = & 180 \quad " \\ \hline & & 680 \quad " \end{array}$$

Since heat and energy can be obtained equally well from either fat or carbohydrate, the proportionate amounts of these foods may be widely varied. Except in excessively cold climates the carbohydrates should predominate, as they are less difficult of digestion. They do not, however, yield as much heat, bulk for bulk, as fats.



Fig. 42.—The comparative caloric value of various foods.¹

¹ Fig. 42 shows a few striking comparisons. From left to right we have white of egg and yolk of egg in equivalent amounts (100 calories); beef broth and olive oil, representing $12\frac{1}{2}$ and 100 calories, respectively; asparagus and figs, corresponding to 25 and 100 calories, and rice, raw, boiled, and puffed, 100 calories being represented in each instance. Figs. 43 and 44 show a diet suitable for a young child. In Fig. 43 we have a breakfast consisting of orange juice, cream of wheat, cream, sugar, milk, roll and butter, also a luncheon, consisting of milk and crackers. In Fig. 44 a dinner, consisting of scraped beef, baked potato, spinach, bread and butter, and a supper, consisting of milk and zwiebach. The orange juice and spinach (as shown by the small tags) represent 50 calories, the others 100 calories, so that by simply counting the units the value of the day's ration is found to equal 1500 calories. This diet may be modified, by taking simple fractions or multiples of the above amounts. The graduated bottles are of eight to ten ounces capacity.



FIG. 43

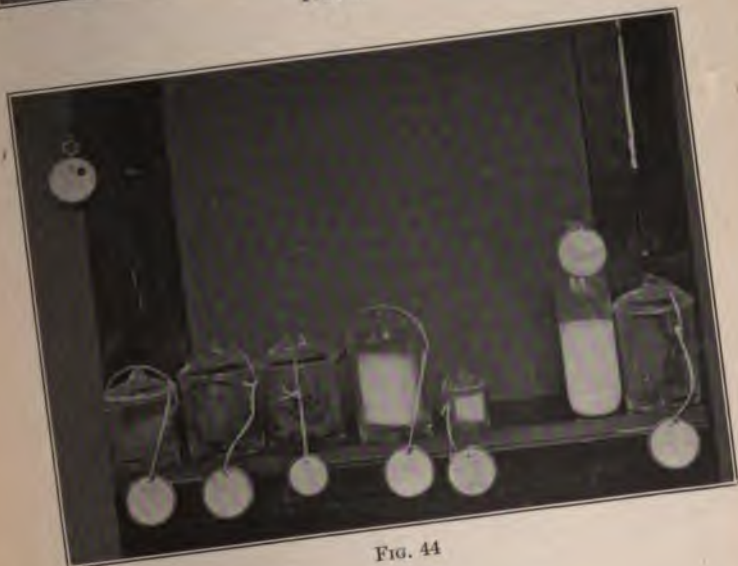


FIG. 44

LIQUID AND SOFT.

Descriptions of portions.¹

| Description of articles. | Rough measure. | Exact measure. | | Protein, grams. | Fat, grams. | Carbo-hydrate, grams. | Calories. |
|---|---|----------------|----------|-----------------|-------------|-----------------------|-----------|
| | | Grams. | Oz., av. | | | | |
| Milk, whole (4 per cent. fat) | A glassful or 7 fluidounces | 217 | 7.6 | 7.1 | 8.7 | 10.8 | 150 |
| Milk, skimmed (0.3 per cent. fat) | A glassful or 6½ fluidounces | 205 | 7.2 | 7.0 | 0.6 | 10.4 | 75 |
| Buttermilk (0.5 per cent. fat) | A glassful or 6½ fluidounces | 210 | 7.4 | 6.3 | 1.1 | 10.0 | 75 |
| Whey (0.3 per cent. fat) | A glassful ("scant") or 6 fluidounces | 187 | 6.6 | 1.9 | 0.6 | 9.4 | 50 |
| Cream (18.5 per cent. fat) | 1½ tablespoonsful or ¾ fluidounce | 20 | 0.9 | 0.6 | 4.8 | 1.1 | 50 |
| Butter (85 per cent. fat) | 1 teaspoonful (rounded) | 7 | 0.2 | -0.1 | 5.5 | 0.0 | 50 |
| Sugar (granulated cane—powdered milk, malt, etc.) | 2 teaspoonfuls (rounded) of granulated, 1 tablespoonful (heaping) of powdered | 13 | 0.4 | 0.0 | 0.0 | 12.5 | 50 |
| Oat or barley gruel (1 oz. of the flour to qt. of water) | A glassful or 7 fluidounces | 218 | 7.6 | 1.0 | 0.0 | 5.2 | 25 |
| Legume gruel (1 oz. of the flour to qt. of water) | A glassful or 7 fluidounces | 217 | 7.6 | 1.7 | 0.0 | 4.6 | 25 |
| Soda crackers (for use with milk) | One cracker | 6 | 0.2 | 0.6 | 0.5 | 4.4 | 25 |
| Toast dried in oven (for use with milk) | 1 thick (3" x 3" x ½") or 2 thin slices (wt. as bread: 39 grams) | 23 | 0.8 | 3.6 | 0.5 | 20.4 | 100 |
| Egg, white of egg (in glass of water, lemonade or beef extract) | One average (weight includes shell) | 57 | 2.0 | 6.8 | 5.3 | 0.0 | 75 |
| Beef (round) scraped | Two average "whites" | 49 | 1.7 | 6.0 | 0.1 | 0.0 | 25 |
| Beef juice (pressed)—Holt | Two small cakes | 64 | 2.3 | 13.6 | 5.0 | 0.0 | 100 |
| Beef broth (Holt, mutton and chicken similar) | Two tablespoonsfuls | 40 | 1.4 | 2.0 | 0.2 | 0.0 | 10 |
| Olive oil (or cottonseed oil) | Large cup or 8 fluidounces | 250 | 8.8 | 2.5 | tr. | 0.0 | 10 |
| Gelatin (1 pkg., gelatin, ½ lb., sugar, 2 qts. water) | One cup or 8 fluidounces | 11 | 0.4 | 0.0 | 11.1 | 0.0 | 100 |
| Junket (1 qt. milk, 2 oz. sugar) | 7 tablespoonsful, ¾ fluidounce | 100 | 3.5 | 1.8 | 0.0 | 11.0 | 50 |
| Soft custard (same with 4 eggs) | 8 tablespoonsful, 4 fluidounces | 119 | 3.9 | 3.6 | 4.4 | 11.7 | 100 |
| Corn starch (1 qt. milk, 2 oz. sugar, 1 oz. corn starch) | 5 tablespoonsful, 2½ fluidounces | 83 | 2.9 | 5.0 | 5.1 | 8.8 | 100 |
| Rice pudding (1 qt. milk, 2 oz. sugar, 3 oz. of rice) | 7 tablespoonsful, 3½ fluidounces | 100 | 3.5 | 3.3 | 4.0 | 13.0 | 100 |
| | 6 tablespoonsful, 3 fluidounces | 83 | 2.9 | 3.3 | 3.3 | 14.4 | 100 |

¹ Additional articles calculated in portions of 100 calories may be found in an article by Fisher, Journal of American Medical Association, 1907 1311, 1316, or in "A Laboratory Hand-book of Dietetics," M. S. Rose, The Macmillan Company, New York, 1913.

The accompanying chart, arranged for hospital use, shows the caloric values of some of the commoner foods as well as the amounts of protein, fat and carbohydrate which are contained in each portion. The portions have been arranged, according to a plan suggested by Prof. Irving Fisher, so as to yield 100 calories, or simple fractions, multiples, etc., of 100.

If we recur to our man of seventy kilos (one hundred and fifty pounds), receiving one hundred grams of protein, ninety grams of fat, and four hundred grams of carbohydrate, we find, as shown by the calculation below, that he is getting in round numbers twenty-eight hundred calories per day, or forty calories for each kilo of weight. This is approximately twenty calories for each pound.

$$\begin{array}{rcl}
 100 \times 4 & = & 400 \text{ calories} \\
 90 \times 9 & = & 810 \quad " \\
 400 \times 4 & = & 1600 \quad " \\
 \hline
 & & 2810
 \end{array}$$

A man at rest in bed will require thirty calories per kilo or fifteen per pound, while a man at very hard labor may "burn up" as much as sixty calories per kilo or thirty per pound. Infants during their first year require more than twice as much in proportion as adults at ordinary work, *e. g.*, eighty to one hundred calories per kilo, equivalent to forty or fifty per pound. This is partly because of their rapid growth and partly because of their proportionately large surface. The greater the relative surface of the body, the greater the amount of heat lost by radiation, which must be made up by increased food intake. It is for this reason that adults require amounts of food proportionate to their height and build (normal weight), rather than to their actual weight.

DISEASES OF METABOLISM.

Obesity.—We have already seen that certain disorders of the ductless glands, and particularly of the thyroid

and pituitary, may lead to obesity. Loss of the function of the ovary, as at the menopause or after operation, is also believed to favor the deposit of excessive amounts of adipose tissue. The exact action of these internal secretions is not known, but it is hardly reasonable to suppose that their influence is in opposition to the ordinary principles of metabolism that have been mentioned. Accumulation of fat indicates either that an excessive amount of food has been ingested, or that the expenditure of energy has been diminished. With increasing weight another factor comes into play, since in a heavy person the relative amount of body or radiating surface is less than in an emaciated individual and therefore the loss of heat is proportionately diminished. Obese persons are also, as a rule, less active than those of normal weight. The treatment of obesity consists therefore either in decreasing the intake by food limitation or in increasing the outgo by exercise, etc. A man of seventy kilos (one hundred and fifty pounds), at moderately heavy work requires, as we have seen, forty calories per kilo, or a total of twenty-eight hundred calories. The problem, therefore, is to reduce the caloric value of the food to a figure decidedly below the requirements, while keeping the exercise at the same level as previously, or conversely, to maintain the diet at a constant level and to increase the exercise. In practice a combination of both methods would be advisable. As it is not the part of wisdom to reduce the muscles or any of the vital organs, protein should not be diminished below the ordinary requirements, but the fat and carbohydrate, one or both, can be largely limited. A too rapid loss of weight is never desirable and is sometimes dangerous. Many diet cures have been proposed, some of which restrict principally the sugars and starches, others the fats, etc. It is comparatively simple, however, to arrange such a regimen for each case with reference to individual tastes or needs. The restriction of water which is often advised, is not desirable because it interferes with proper elimination and is

moreover of doubtful efficacy. Sweating by means of hot-air or vapor baths also acts by withdrawing fluid, but while it is not open to the same objections as the restriction of water, it is usually only of temporary benefit, as water is immediately retained to replace that which has been lost. Thyroid extract has been largely used to diminish weight and is of unquestioned value in myxedema, for example, but in other cases is not without serious drawbacks unless carefully watched.

Inanition and Malnutrition.—Adults rarely suffer from simple malnutrition without definite underlying disease, though patients are occasionally admitted to the wards of our hospitals whose only requirement is three "square" meals a day. In infants, particularly in those of bad heredity, acute inanition and chronic malnutrition (marasmus), may be brought about by improper, ill-balanced food and unhygienic surroundings. The role of impure milk and of infection in causing digestive (intestinal) disturbances has already been emphasized. In the cases now under consideration the difficulty is one of faulty metabolism. One or more of the constituents of the food is badly assimilated or may even be toxic to the infant; fats and sugars are more often at fault than proteins. In a particular case the metabolic balance may frequently be restored by limiting the offending substance and for this purpose numberless expedients have been devised. Thus whey, with cream, may be used when the protein is to be reduced, skim milk or buttermilk, when the fat is chiefly at fault, and protein milk, when the sugar is the chief offender.¹ The symptoms of inanition comprise digestive derangements such as loss of appetite, vomiting and diarrhea, and nutritional disturbances such as pallor, weakness, loss of weight, loose, wrinkled skin (senile expression), flabby muscles,

¹ Protein milk consists of the strained and finely divided curd, which has been separated by rennet from a quart of milk, mixed with a pint each of buttermilk and water.

etc. In severe cases nervous or toxic symptoms, restlessness, stupor, etc., may develop.

Malnutrition, both in adults and children, is common as a sequence of chronic disease. The purest variety is that which occurs in benign stenosis (narrowing) of the esophagus, in which little or no food reaches the stomach. In chronic gastric and intestinal disease sufficient food may be introduced, but it is not properly assimilated. In severe infections, such as tuberculosis and in malignant disease, a toxic factor is added, while in certain forms of thyroid disease there seems to be an acceleration of metabolism.

In the treatment of malnutrition in adults liberal but not excessive amounts of protein (seventy-five to one hundred and fifty grams) should be administered to supply material for the maintenance and repair of the wasted tissues and organs. Fats and carbohydrates, one or both, should be given in excess in order to meet the necessary current demands for heat and energy, and to provide an overplus to be stored in the form of fat and glycogen. To our hypothetical patient who normally would require twenty-eight hundred calories, we must supply several hundred extra. One authority states that if one quart (liter) of milk, corresponding to six hundred and eighty calories, is given in addition to a diet which is otherwise sufficient for a patient's normal needs, a gain of one and one-half pounds per week may be expected. The effect may be increased by fortifying the milk by additions of cream and milk-sugar.

In many cases of malnutrition, particularly in infancy, it is not so much the quantity of the food that causes trouble as the difficulty in getting any food to agree with the patient. When the mother's milk has failed or been discontinued, it is important and sometimes even absolutely essential to obtain a wet-nurse. In cases which have followed prolonged experimental feeding with proprietary foods, rational milk modifications will often bring about recovery. Mothers, on the advice of friends

and neighbors, frequently try a great variety of proprietary foods, most of which may be essentially the same. If experimentation is to be carried out, it should be done with an appreciation of the composition of the food. Fats, sugars, starches and proteins most often disagree, approximately in the order named, so that in the absence of any diagnostic symptoms, each in turn may be restricted or modified.

Diabetes Mellitus.—In diabetes there is a disturbance of the metabolism of sugars and starches. As we have seen, normal persons convert ordinary amounts of sugar (less than six or seven ounces at one time) into heat and energy, or “warehouse” it, as fat or glycogen (in the liver). Other individuals, usually gouty, obese, or alcoholic, may show sugar in the urine on an ordinary diet. These cases are readily controlled by moderate restriction, and their condition is spoken of as glycosuria. In diabetes there is an excretion of sugar when starches alone are taken, and in the severer cases even when the diet is limited to fat and protein. There seems to be a more or less complete inability to burn up the ingested carbohydrates, which are therefore excreted unaltered in the form of glucose. In severe cases as much as five hundred grams (one pound) a day are lost in the urine, corresponding to two thousand calories. To meet the needs of the body the protein, even that of the tissues themselves, may be partly converted into sugar; this explains in part the rapid emaciation and the presence of sugar in the urine when no sugar and starch are taken. Finally, there may be a disturbance in the fat metabolism with the formation of injurious fatty acids, leading in certain cases to “acid intoxication.” In the latter condition diacetic acid and acetone are found in the urine.

Cause.—The underlying causes of diabetes are numerous, the most important being affections of the pancreas, brain, and liver. Diabetes is more common in men than in women and in the well-to-do than in the poor. In young adults it is accompanied by emaciation and pursues

a subacute course. In obese persons past middle life it is more chronic and less fatal. In this class of persons the disease may be unsuspected until the urine happens to be tested in a routine examination. Other patients come to the physician on account of skin complications, particularly itching, boils, and shingles.

Symptoms.—The most characteristic symptom of diabetes is the frequent passage of large quantities of pale urine (polyuria) of high specific gravity. If the case is one of diabetes, this will be found to contain sugar and perhaps acetone. The daily amount in extreme cases may be as much as ten quarts, with perhaps five per cent. of sugar, or in other words, a pound a day. As a result of the enormous excretion of water, there is severe thirst, harsh, dry skin, and constipation. The great waste of nutriment leads to increased appetite, emaciation (in most cases), and weakness (in women, cessation of the menses). The tongue is often dry and red. Important complications, not already mentioned, are cataract, neuritis, tuberculosis, gangrene, and acid intoxication. One of the three last named is usually responsible for the fatal outcome. Acid intoxication is heralded by increased amounts of acetone in the urine, headache, vertigo, restlessness, delirium, somnolence, and coma. The respiration is rapid and deep ("air hunger") and the breath is said to have a "fruity" odor. Acid intoxication is favored by too prolonged adherence to a strict diet.

Treatment.—The treatment of diabetes is largely dietetic. It is usual to prescribe at first a diet practically free from sugar and starch (fifty grams or less). If the sugar disappears (mild cases), measured quantities of bread or other starchy food are added, taking care not to give enough to cause the reappearance of sugar. Protein and fat must be given in large quantities to make up the necessary food (caloric) value. Saccharin may be used for sweetening in place of sugar (two or three grains, with an equal amount of sodium bicarbonate).

If sugar does not disappear under the above conditions

(severe cases) a strict diet may be employed, but it must yield enough energy to compensate for the sugar that is lost, otherwise the patient will lose weight. In patients taking such limited amounts of carbohydrate and such an excess of protein and fat, the danger of acid intoxication is ever present and the nurse should be constantly on the watch for suggestive symptoms. To diminish the danger, starvation or green days are prescribed, during which the food is limited almost entirely to green vegetables, or an exclusive diet of oatmeal is prescribed. If acetone and diacetic acid appear in the urine large doses of sodium bicarbonate are administered by the mouth or rectum. In the actual presence of coma there is little hope, but large intravenous injections of sodium bicarbonate solution (2 to 5 per cent. in physiological salt solution) may be tried.

Another method of treatment, for which Dr. Allen is largely responsible, is based on the assumption that diabetes is the expression of a weakened function, and that its manifestations may be avoided if the diet is kept well within the patient's tolerance. Proteins and fats must be restricted as well as carbohydrates, which is possible, since loss of weight, within reasonable bounds, is regarded as rather beneficial than otherwise. The treatment is initiated by a period of starvation, which is continued, sometimes with remissions, until the urine is free from sugar and acetone. During this period water is allowed freely, beef broth and whisky in measured amounts. When the urine is sugar-free, green vegetables are cautiously given, and then gradually other starch-containing foods, until the amount of carbohydrate which the patient can tolerate, without the appearance of sugar in the urine, has been determined. Subsequently the protein and fat toleration is similarly determined. As the tolerance usually improves under this careful regime, retests may be made from time to time, with the object of allowing the patient greater latitude. Frequent examinations of the urine for sugar are necessary to control this treat-

ment. These are made by the nurse or patient. The details of the Allen treatment have been condensed and printed on a small card by Dr. Joslin, of Boston.¹ Another card of uniform size gives the technic of the Benedict test for sugar.² (See below.)

DIRECTIONS FOR THE ALLEN TREATMENT.

Fasting.—Fast until sugar-free. Drink water freely and tea, coffee and clear meat broth as desired. In very severe, long-standing and complicated cases, without otherwise changing habits or diet, omit fat, after two days omit protein and halve carbohydrate daily to 10 grams, then fast.

Carbohydrate Tolerance.—When the twenty-four-hour urine is sugar-free, add 150 grams of 5 per cent. vegetables, and continue to add 5 grams carbohydrates daily up to 20, and then 5 grams every other day, passing successively upward through the 5, 10, and 15 per cent. vegetables, 5 and 10 per cent. fruits, potato and oatmeal to bread, unless sugar appears or the tolerance reaches 3 grams carbohydrate per kilogram body weight.

Protein Tolerance.—When the urine has been sugar-free for two days add 20 grams protein (3 eggs) and thereafter 15 grams protein daily in the form of meat until the patient is receiving 1 gram protein per kilogram body weight, or if the carbohydrate tolerance is zero, only $\frac{1}{2}$ gram per kilogram body weight.

Fat Tolerance.—While testing the protein tolerance a small quantity of fat is included in the eggs and meat given. Add no more fat until the protein reaches 1 gram per kilogram (unless the protein tolerance is below this figure) but then add 25 grams daily until the patient ceases to lose weight or receives not over 40 calories per kilogram body weight.

¹ Form J 8. For sale by Thomas Groom & Co., 105 State St., Boston.

² Ibid., Form J 5.

STRICT DIET.—MEATS, FISH, BROTHS, GELATIN, EGGS, BUTTER, OLIVE OIL,
COFFEE, TEA AND CRACKED COCOA.
FOODS ARRANGED APPROXIMATELY ACCORDING TO PERCENTAGE OF
CARBOHYDRATES.

| VEGETABLES (Fresh or canned) | 10% | 15% | 20% |
|---|--|--|--|
| 5% ¹ Lettuce Cucumbers Spinach Asparagus Rhubarb Kidney Marrow, Sorrel Sauerkraut Beet greens Dandelion greens Swiss chard Celery | 5% ¹ Pumpkin Turnip Kohlrabi Squash Beets Carrots Onions Mushrooms | 15% Green peas Artichokes Parsnips Canned lima beans | 20% Potatoes Shell beans Baked beans Green corn Boiled rice Boiled macaroni |
| FRUITS Ripe olives (20 per cent.) Grapefruit | Lemons Oranges Cranberries Strawberries Blackberries Gooseberries Peaches Pineapple Watermelon | Apples Pears Apricots Blueberries Cherries Currants Raspberries Huckleberries | Plums Bananas Prunes |
| NUTS Butternuts Pignolias | Brasil nuts Black walnuts Hickory nuts Pecans Filberts | Almonds Walnuts (English) Beechnuts Pistachias Pine nuts | Peanuts 40% Chestnuts |

¹ Reckon available carbohydrates in vegetables of 5% group as 3% of 10% group as 6%.

MISCELLANEOUS

| Unsweetened and unsipped pickle Saloop | Clams Liver | Oysters Fish roe | | |
|--|--------------------|--------------------------------|------------------------------|-----------|
| 30 grams (1 oz.) contain approximately: | Protein, grams. | Fat, grams. | Carbo- hydrate, grams. | Calories. |
| Oatmeal, dry weight | 5.0 | 2 | 20.0 | 120 |
| Cream, 40 per cent. | 1.0 | 12 | 1.0 | 120 |
| Cream, 20 per cent. | 1.0 | 6 | 1.0 | 60 |
| Milk | 1.0 | 1 | 1.5 | 20 |
| Brasil nuts | 5.0 | 20 | 2.0 | 210 |
| Oysters, six | 6.0 | 1 | 4.0 | 50 |
| Meat (uncooked, lean) | 6.0 | 3 | 0 | 50 |
| Meat (cooked, lean) | 8.0 | 5 | 0 | 75 |
| Bacon | 5.0 | 15 | 0 | 155 |
| Egg (one) | 6.0 | 6 | 0 | 75 |
| Vegetables 5% group | 0.5 | 0 | 1.0 | 6 |
| Vegetables 10% group | 0.5 | 0 | 2.0 | 10 |
| Potato | 1.0 | 0 | 6.0 | 30 |
| Bread | 3.0 | 0 | 18.0 | 90 |
| Butter | 0 | 25 | 0 | 225 |
| Broth | 0.7 | 0 | 0 | 3 |
| Small orange or 1/3 grapefruit | 0 | 0 | 10.0 | 40 |
| 1 gram protein, | 4 calories. | 1 kilogram = 2.2 pounds. | | |
| 1 gram carbohydrate, 4 " | | 30 grams (gm.) or cubic centi- | | |
| 1 gram fat, | 9 " | mers (c.c.) = 1 ounce. | | |
| 1 gram alcohol, | 7 " | A patient at rest requires 25 | | |
| 6.25 grams protein contain 1 | | calories per kilo body weight. | | |
| gram nitrogen. | | | | |

Consult the Chemical Composition of American Food Materials, Bulletin No. 28, U. S. Dept. Agriculture, by sending 10 cents in coin to Superintendent of Documents, Washington, D. C.; also Annual Report of the Connecticut Agricultural Experiment Station, New Haven; Conn., Food Products and Drugs, 1913, Part I, Section 1.—Free.

Reappearance of Sugar.—The return of sugar demands fasting for twenty-four hours or until sugar-free. The diet is then increased twice as rapidly as before, but the carbohydrate should not exceed half the former tolerance until the urine has been sugar-free for two weeks, and it should not then be increased more than 5 grams per week.

Weekly Fast Days.—Whenever the tolerance is less than 20 grams carbohydrate, fasting should be practised one day in seven; when the tolerance is between 20 and 50 grams carbohydrate, upon the weekly fast day 5 per cent. vegetables and one-half the usual quantity of protein and fat are allowed; when the tolerance is between 50 and 100 grams carbohydrate, the 10 and 15 per cent. vegetables are added as well. If the tolerance is more than 100 grams carbohydrate upon weekly fast days the carbohydrate should be halved.

FORMULA AND DIRECTIONS FOR THE BENEDICT TEST.

| | |
|--|-------------|
| Copper sulphate (pure crystallized) | 17.3 g. |
| Sodium or potassium citrate | 173.0 g. |
| Sodium carbonate (crystallized) ¹ | 200.0 g. |
| Distilled water to make | 1000.0 c.c. |

The citrate and carbonate are dissolved together (with the aid of heat) in about 700 c.c. of water. The mixture is then poured (through a filter) if necessary, into a larger beaker or casserole. The copper sulphate (which should be dissolved separately in about 100 c.c. of water) is then poured slowly into the first solution, with constant stirring. The mixture is then cooled and diluted to one liter. This solution keeps indefinitely.

For the detection of glucose in the urine about 5 c.c. of the reagent are placed in a test-tube and 8 to 10 drops (not more) of the urine to be examined are added. The mixture is then heated to vigorous boiling, kept at this temperature for one or two minutes, and allowed to cool

¹ One-half the weight of the anhydrous salt may be used.

spontaneously. In the presence of glucose the entire body of the solution will be filled with a precipitate, which may be red, yellow or greenish in tinge. If the quantity of glucose be low (under 0.3 per cent.) the precipitate forms only on cooling. If no sugar be present, the solution either remains perfectly clear, or shows a faint turbidity that is blue in color, and consists of precipitated urates. The chief points to be remembered in the use of the reagent are (1) the addition of a small quantity of urine (8 to 10 drops) to 5 c.c. of the reagent, this being desired not because larger amounts of normal urine would cause reduction of the reagent, but because more delicate results are obtained by this procedure; (2) vigorous boiling of the solution after addition of the urine, and then allowing the mixture to cool spontaneously; and (3) if sugar be present the solution (either before or after cooling) will be filled from top to bottom with a precipitate, so that the mixture becomes opaque.

It is often convenient to perform the test by placing the tube containing the mixture of the solution and urine in bubbling, boiling water, where it must remain with the water actually boiling for five minutes.

Medical Treatment.—The medicinal treatment of diabetes has little rational basis, but arsenic or opium (codein) sometimes seems to be of benefit. Local pruritus (itching) is common in women; it may be relieved by scrupulous cleanliness and lotions or ointments of boric acid, phenol (carbolic acid), menthol, etc. If gangrene occurs amputation is necessary, though often ineffectual or fatal.

Diabetes Insipidus.—Diabetes insipidus is characterized by the passage of large amounts of pale urine of very low specific gravity, containing neither albumin, sugar, nor casts. The quantity of urine is sometimes enormous and thirst correspondingly severe, but the disease is not in itself dangerous to life. In this disease the kidneys are unable to retain the water which is brought to them, or in other terms, the kidneys are incapable of secreting urine of normal concentration.

Gout.—Gout is a constitutional disease associated with an increase of the uric acid in the blood, and deposits of uric acid in the cartilages and tendons and about the joints. In the acute form the great toe is most frequently involved, but many other joints may also be attacked. In the chronic form "chalky" deposits are most often seen near the margins of the ears and about the small joints of the hands and feet. Many ailments of obscure origin—joint and muscle pains, sore throats, dyspeptic attacks, etc.—have been conveniently attributed to the gouty or uric-acid diathesis, but up to the present it has not even been proved that gout itself is due to uric acid, though as we have said, the two are closely associated. Uric acid is derived from the nuclei cells and is therefore abundant in glandular organs. Ordinary meat (muscle) contains comparatively little. The amount of uric acid can be reduced by avoiding articles like liver, kidney, sweetbreads and, to a less extent, meats, peas, beans, etc. But even if the patient lives on milk, eggs, starch, oils and other articles devoid of uric acid, a certain amount can still be found in the blood and urine. This portion is derived from the normal breaking down of the body cells themselves in consequence of ordinary wear and tear.

Gout is brought about by high living and a free consumption of heavy wines and malt liquors. Lead workers are also liable to it. Heredity is said to be an important factor. It is traditionally frequent among the upper classes in England, but typical cases, either acute or chronic, are rare in this country. It is unusual to see more than one or two cases a year in a large hospital service. An attack of acute gout comes on suddenly, often in the night, with intense pain, usually in the foot or great toe. The joint is swollen, red and shiny and extremely sensitive, so that it is necessary to arrange a cradle to keep off the weight of the bedclothes. There is usually little or no fever. With or without cold applications and other treatment, the intensity of the swelling

PLATE IV



Rachitis.

Showing the cuboidal shape of the head, the thoracic
the beaded ribs, the protuberant abdomen, and the enlar-
end of the radius. (Koplik.)

ty.
3r



soon subsides but nocturnal exacerbations may prolong the attack for several days. Recurring attacks are common, induced by indiscretions of diet, excessive drinking, etc. Chronic gout is characterized by knobby swellings about the joints of the fingers and toes, producing great deformity. It has nothing to do with arthritis deformans which is sometimes called "rheumatic gout."

Treatment.—From what has been said the dietetic treatment is obvious. Considering the comparative rarity of the disease it would hardly be profitable to discuss the treatment in detail. It may be mentioned that colchicum is supposed to have an almost specific effect in acute gout.

Rickets.—The striking feature in the metabolism of rickets is the inability to retain or make use of the calcium salts (phosphates), the principal mineral constituents of bones, in spite of the fact that there may be no lack of them in the food. The disease is due to defective food and bad hygienic surroundings. It usually begins in the first year in infants whose diet has been insufficient or improper. It occurs in breast-fed infants, but much more often in those who have been artificially fed on mixtures deficient in fat and protein. Condensed milk and starchy proprietary foods are principally responsible.

The earliest symptoms are sweating about the head, restlessness during sleep, persistence of the fontanel, soft spots in the skull ("craniotabes"), delay in teething and walking, etc. Later deformities are noticed: a square head with lateral and frontal bosses, beading at the junction of the ribs and rib cartilages ("rosary"), lateral grooves in the chest, pigeon-breast and funnel-breast, lateral curvature of the spine, enlargements near the large joints (*e. g.*, the wrists), curvature of the long bones (bow-legs and knock-knees), etc. The abdomen is prominent and the spleen large. Dyspeptic symptoms and constipation are usual. It is believed by some that rickets is answerable for ptosis of the stomach and kidneys, so fruitful of symptoms in later life.

In the second or third year when the diet becomes more

varied, the acute symptoms usually clear up and the deformities, if not extreme, almost vanish in time. Many cases, however, remain in which braces or subsequent operative procedures are required to correct deformity (orthopedic surgery).

Treatment.—The medical treatment consists in good hygienic surroundings, fresh air (seashore), abundant food, with fats (cream, butter, and olive oil), and the administration of phosphorus and cod-liver oil. The latter is to be considered merely as a food. In infants, if a proper dietary or milk mixture is prescribed at the very beginning, severe symptoms may often be prevented. Many cases are complicated by intolerance of fatty food, etc., so that the disease is warded off with the greatest difficulty or not at all. If there is anemia, iron may be of benefit.

Scurvy.—Scurvy is a metabolic disorder due to the lack of certain substances (vitamins) which are found in fresh fruit (oranges, limes, lemons), green vegetables, potatoes, etc. It was formerly extremely prevalent in ships on long voyages, in prisons, asylums, and almshouses. About a century ago it was found that lime juice would prevent the development of the disease so that its use was made compulsory first in the English navy, and later in the merchant vessels of England and other nations. As a result the disease has become rather rare. Several years ago I happened to see a severe case in a foreigner who had lived alone, subsisting entirely on sausage, bread, and beer, with an occasional doughnut. Infantile scurvy is by no means so rare and almost always follows the exclusive use of sterilized milk and other cooked foods.

In adults the symptoms are swelling and sponginess of the gums, which are of a purple color and bleed easily, bloody urine, anemia, and subcutaneous and subperiosteal hemorrhages. The latter are situated, as a rule, along the tibia, at the front of the leg, and are accompanied by tenderness.

Scorbutic infants may or may not be rickety. The

baby cries when handled and superficial swellings are seen, particularly near the joints. With a history of an unsuitable diet and the presence of spongy gums the diagnosis is easy. The condition may be mistaken for rheumatism.

Treatment.—The treatment is of the simplest. In adults an ordinary nourishing diet with orange juice and green vegetables rapidly restores health. In infants a diet of fresh milk and orange juice, and in older children the same, with the addition of potatoes, accomplishes the same marvelous results without any medicine whatever.

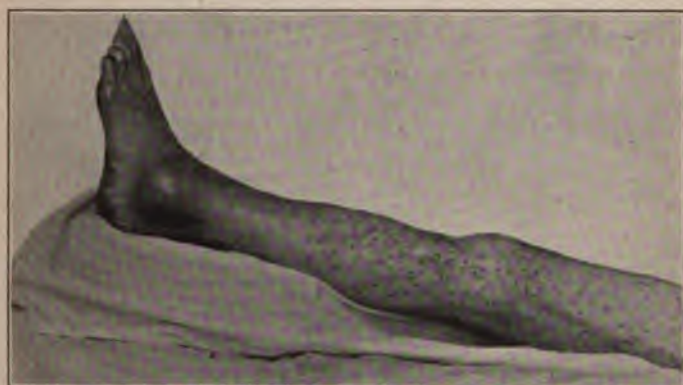


FIG. 45.—Scurvy showing petechiæ and extensive hemorrhagic infiltration about ankle. The patient had spongy, bleeding gums.

Osteomalacia.—Osteomalacia is a rare nutritional disease, occurring most often in pregnant women. In this affection there is a peculiar softening (decalcification) of the bones which permits of free bending and great deformity.

Beriberi.—Beriberi is a form of multiple neuritis (*q. v.*) which is due in whole or in part to nutritional disturbances. The part that infection may play in its etiology has not been finally settled. It is widely prevalent in Japan and in our own Philippines, and is there attributed

to the use of polished rice. The process of milling removes substances which, though found only in minute amounts, are vital to the organism. These "vitamins" are abundant in a mixed diet, but are deficient in the exclusive rice diet of the tropics. Recently cases have been reported from Newfoundland (!) where the food of many of the inhabitants is limited to salt meat, fish, and articles made from flour (bolted). Bolted flour is probably as unsuitable as polished rice, as an exclusive article of diet.

The disease is subacute or chronic and is characterized by the symptoms of multiple neuritis (including weakness and paralysis of the extremities), with or without generalized dropsy. The dropsical variety is known as wet beriberi, the simple paralytic, as dry.

Pellagra—This disease, which has long been a well-known scourge in northern Italy, Roumania, and elsewhere, has recently assumed great importance in this country. In the Southern States it vies with hookworm disease in absorbing the attention of medical men. Even in the North cases have been reported from many if not all of the States. That a disease of such chronicity and apparently such slight infectivity—if it be infectious at all—should have spread so rapidly is astounding. It is perhaps more reasonable to suppose that mild cases have been present, but not diagnosed, for a much longer time. The chief interest in pellagra has been in its etiology. In the countries where the disease has been most prevalent Indian corn (polenta) has long been a staple article of diet among the people. Many attempts have therefore been made to trace this disease to spoiled corn, but that this cannot be the essential factor is shown by the fact that many people develop the affection who have never tasted Indian meal. At the present time some authorities believe it to be due to a poorly balanced, monotonous diet, lacking in certain essential elements, while others attribute it to an insect-borne (sand-fleas) infection.

The chief symptoms are cutaneous, gastro-intestinal

and mental. The disease, except in occasional acute cases, lasts for several years, improving in winter and getting worse in the warm weather. The eruption is found on the back of the neck, the backs of the hands, and forearms, on the lower part of the legs, etc. The skin is pigmented and reddened and presents an appearance not altogether unlike eczema. The eruption is almost



FIG. 46.—Pellagra. (Siler, Garrison and MacNeal-Thompson-McFadden Pellagra Commission.)

always symmetrical. The general symptoms are those of recurrent digestive disturbances and diarrhea with weakness and emaciation. As the disease progresses, it is complicated by confusion, hallucinations, mental depression, etc., progressing to complete dementia. The ultimate prognosis is bad, both as to recovery and improvement.

Myalgia and *arthritis deformans* are discussed in the section on Diseases of the Muscles, Bones, and Joints.

PART VII.

DISEASES OF THE URINARY PASSAGES AND KIDNEYS.

GENERAL CONSIDERATIONS.

The Urine.

Functional Tests of the Kidney.

Miscellaneous Signs and Symptoms.

Catheterization, etc.

DISEASES OF THE URINARY PASSAGES AND KIDNEYS.

Incontinence of Urine and Enuresis.

Ascending and Descending Infections.

Cystitis.

Pyelitis.

Stone.

Tumors.

Abscess.

Movable Kidney.

Nephritis and Uremia.

General Considerations.—The Urine.—The *daily excretion* of urine ordinarily amounts to two or three pints (one thousand to fifteen hundred c.c.), but may vary widely even beyond these limits, depending on the fluid intake, temperature of the air, etc. Anuria, oliguria, and polyuria denote pathological variations; suppression, diminished and increased secretion respectively. The urine is often temporarily suppressed in acute nephritis, it is scanty in fevers, it is increased in amount in chronic interstitial nephritis and in diabetes. In collecting twenty-four-hour specimens the bladder should be emptied at a certain hour and the specimen discarded. All urine passed subsequently should be saved until the same hour the next day when the bladder should again be emptied and this final specimen added to the total. The urine should be kept in a cold place in a large clean bottle. A half-teaspoonful of powdered thymol is the best pre-

servative. The bottle should be frequently shaken after each addition to mix the thymol. The *specific gravity* is usually inversely proportional to the quantity: in diabetes, on the other hand, in spite of the increased volume of urine, it is high. The specific gravity, normally, varies between 1015 and 1025 (water being taken as 1000). In chronic nephritis and diabetes insipidus it is low, in diabetes mellitus it is high. The *reaction* to litmus is usually acid (blue litmus paper is changed to red), but may be alkaline (red litmus paper is changed to blue) after heavy meals, or after certain drugs such as sodium bicarbonate, etc. In cystitis with ammoniacal decomposition the reaction is persistently alkaline. The *color* varies between pale yellow and a deep reddish yellow or amber. Perfectly normal urine is transparent with a delicate floating cloud. If the urine is alkaline a heavy white precipitate of phosphates soon separates out. These may be redissolved by adding a little acid. If the urine is concentrated (reddish color) and acid, or the weather cold, a profuse brick-red sediment will settle on standing, or minute garnet-like crystals will be seen at the bottom of the container. These sediments consist of urates and uric acid respectively and may be dissolved by heating. Patients frequently attach great significance to these sediments, believing that they are signs of serious disease. As a matter of fact they indicate nothing of importance (low water intake, cold weather, etc.). Permanent sediment or cloudiness, not abolished by heat or acid, may be due to suspended bacteria (*e. g.*, in typhoid), pus, blood, etc. The final arbiter in these cases is the microscope. A "smoky" or distinctly red color of the urine suggests blood, an orange color, bile (yellow foam on shaking), a green or blue color, drugs (methylene blue).

Albumin in the urine may mean pus or blood and is then usually small in amount. The pus or blood may originate from a focus of inflammation or irritation anywhere in the urinary passages, or may be an accidental contamination (from the vagina). For the latter reason

catheterization is sometimes necessary in doubtful cases. If pus or blood is absent or casts are present, the albumin may be assumed to be of renal origin. It may be very scanty in chronic nephritis or the urine may boil solid when the disease is acute or severe. Albumin is almost constant in the congested kidney of heart disease and in fevers. The simplest test for albumin is by boiling. A little acid is added to keep other substances (phosphates) in solution and to aid in the precipitation of the albumin. Being similar to egg-white the albumin is coagulated by the heat and appears as a cloud or in large flakes. Another simple test depends on the coagulation of the albumin by concentrated nitric acid. About 2 c.c. ($\frac{1}{2}$ dram) of nitric acid are poured into a test-tube and then an equal amount of urine is allowed to flow in slowly so as to form a layer above the heavier acid. A white ring at the junction of the fluids indicates the presence of albumin.

The presence of *sugar* (glucose) is most certainly indicated by fermentation. A fermentation tube is filled with urine to which a portion of a compressed yeast-cake has been added, and is allowed to stand for twenty-four hours in a warm place. If sugar is present, carbonic-acid gas will collect in the upper part of the tube. The easiest and most commonly employed test is the one known as Fehling's, which depends on the decomposition of an alkaline solution of copper sulphate by glucose. The details of this and other tests, if it should be necessary for the nurse to perform them, are to be found in any laboratory manual. Other substances sought for in an ordinary routine examination are *acetone* and *indican*. The former indicates the possibility of acid intoxication, the latter suggests putrefactive changes in the intestine. The *dialo* test is a color reaction which occurs in typhoid fever and miliary tuberculosis, rarely in other conditions.

The *microscopic* examination of the urine confirms the presence of blood (red blood cells), pus, bacteria, and the various crystals and formless sediments. Epithelial cells, characteristic of the various portions of the urinary tract,

and of the vagina, are seen in large quantities. The most important objects are casts; these are pale, elongated, and cigar-shaped (hyaline casts). They may be covered with, or composed of, epithelial cells, granules, blood, or pus, depending upon the character and severity of the kidney affection (epithelial, granular, blood, and pus casts).

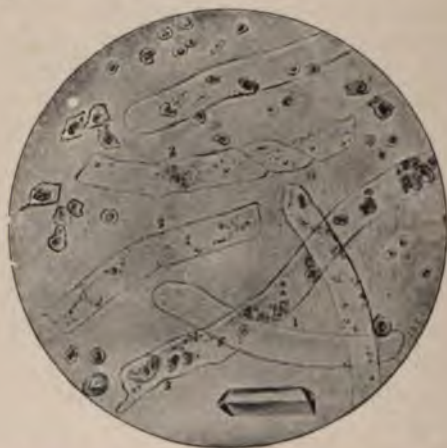


FIG. 47.—Hyaline casts from a case of acute nephritis. (Musser.)

Functional Tests of the Kidney.—The excretory function of the kidney is often determined by so-called functional tests. An explanation of the principle underlying the one most commonly employed, the phenolsulphonephthalein test, will serve as an illustration. A known quantity of the special dye is injected into the lumbar muscles with aseptic precautions, by means of an accurately graduated glass syringe. If the kidneys are normal the dye begins to be excreted within ten minutes and the greater part (80 per cent. approximately) is eliminated within two hours. In practice the urine is collected for two hours, in two separate portions, treated with an alkali to bring out the color, and compared with a color scale.

Miscellaneous Signs and Symptoms.—The blood-pressure is elevated in chronic diffuse nephritis and in uremia. Systolic pressures of 200 to 300 mm. are not rare. With high blood-pressure the pulse is of high tension. The technic of blood-pressure estimations has been described under Cardiovascular Diseases (page 88).

Cheyne-Stokes respiration, also described previously, (page 116) is peculiarly characteristic of uremia. Sometimes the respiratory distress in uremia closely simulates asthma.

The edema of kidney disease differs from that of cardiac disease in that it is not dependent upon gravity, but appears first in the eyelids rather than in the ankles or back. It may be general in the subcutaneous tissues without being excessive in the lower extremities. When cardiac dilatation takes place, the edema will partake of the character of cardiac edema.

The convulsions which occur in uremia are of the epileptiform type, like those described in the section on Nervous Diseases; the coma in many instances is also indistinguishable from that of cerebral disease. The convulsions which occur in pregnancy and the puerperium are designated as eclamptic. They are often, but not always, due to primary kidney insufficiency.

Catheterization, etc.—Catheterization is required not only in primary disorders of the bladder and urinary passages, but also in diseases of other organs (*e. g.*, the brain and spinal cord). Sometimes it is necessary to secure uncontaminated specimens for examination. In the case of women, the nurse will frequently be called upon to perform this operation. On account of the liability of the diseased bladder to infection, the most scrupulous care should be used in the sterilization of catheters and the disinfection of the hands, urethral surroundings, etc. The best technic includes, in addition to ordinary disinfection of the hands, the use of rubber gloves. The glass, or better, soft-rubber catheter, should be boiled and well lubricated with sterilized olive oil or a

similar lubricant. The urethra and the labia should be thoroughly cleansed, with or without the use of boric acid or weak bichloride solution, and, while the labia are separated with one hand, the catheter should be introduced directly into the urethral opening without touching surrounding structures. For this a good light is essential. The details of this operation are given in books on nursing. For males, woven silk or metal catheters may be needed in addition to the soft-rubber ones, though the latter will usually suffice in ordinary medical cases. A solid metal sound, curved somewhat less than a male catheter, is employed to detect the presence of calculi (clinking sound or sensation). At the present day the physician also has the *x*-rays at his command for this purpose.

The use of the cystoscope for observing the mucous membrane of the bladder directly is seldom called for in simple medical cases. Catheterization of the ureters, which involves the use of the cystoscope, is more likely to be of use, *e. g.*, in the determination of the particular kidney involved by tuberculous disease. If an examination of this sort were needed a specialist would be called in for the purpose of making it.

DISEASES OF THE URINARY PASSAGES AND KIDNEYS.

Incontinence of Urine and Enuresis.—Incontinence of urine is common in the aged and in organic nervous diseases, as a result of relaxation (perineal tears), partial obstruction (stricture or enlarged prostate), and disorders of innervation. It may also occur in the young as the result of malformations. In infants it is a normal condition until the end of the first or second year. Control during the day is first acquired, later at night. Even normal children may wet at night for several years. Enuresis or incontinence of urine in late infancy and childhood is usually nocturnal, but may occur during the day as well. The principal causes of the latter type of

enuresis are irritability of the bladder and functional or organic disturbances of the central nervous system. It is persistent or permanent in those of low mentality.

Treatment.—The treatment of enuresis in children consists in systematic training, "moral" suasion, restriction of fluid at night, and the use of drugs, belladonna (atropin) or strychnin. Atropin is usually the most effectual remedy. Masturbation, phimosis, vaginitis, "worms," and other local causes should be corrected. The child should pass urine on going to bed and again when the parents retire.

Ascending and Descending Infections.—The urinary passages comprise the following natural subdivision from the kidney downward: the pelvis of the kidney, the ureter, the bladder, and the urethra. As the affections of this tract have a close connection one with the other, the general causes and symptoms which they have in common may be considered together. Chemical and mechanical factors are of great importance, particularly when combined with infection, in the etiology of disorders of the urinary tract. Mobility of the kidney may cause kinking of the ureter, but this is usually acute and leads to severe pain and colic rather than to chronic obstruction. If the latter should occur from this cause or from inflammatory stricture, a hydronephrosis may result, that is, distention of the pelvis of the kidneys with urine. Sometimes the obstruction is intermittent, and temporary retention is followed by the passage of enormous quantities of urine (intermittent hydronephrosis). Stones in the kidney or bladder may cause mechanical irritation and inflammation, and in the ureter or urethra, pain or obstruction. The commonest causes of chronic obstruction are gonorrheal stricture and hypertrophy of the prostate. If infection is added to obstruction the disease travels upward, successively involving the urethra, bladder, ureter, pelvis, and kidney. This is spoken of as an *ascending infection* and is common in neglected cases of obstruction from all causes. If the infection, on the other

hand, begins in the kidney or pelvis and travels downward it is called a *descending infection*. Infections by the typhoid bacillus and tubercle bacillus are commonly of the latter type, beginning above and travelling downward. Infections by the gonococcus and colon bacillus, on the other hand, usually begin in the urethra or bladder and travel upward. Even if these infections are at first pure, they are liable soon to be associated with infection by the ordinary pus organisms (mixed infection). To the latter are due ordinary septic symptoms such as irregular fever, sweats, and chills.

Cystitis.—Cystitis (inflammation of the bladder) may be due to overdistention, to sudden chilling, etc., without obvious evidence of infection, and to the general causes which have been mentioned. A fruitful cause of infection is carelessness in the use of the catheter, particularly after pelvic operations, which may reduce the resistance of the bladder. So much is this the case that at the present day routine catheterization has been largely abandoned by operators, with a greatly lessened incidence of cystitis. Simple cystitis is usually acute and tends to spontaneous cure. The infectious form, unless carefully treated, is liable to become chronic.

Symptoms.—The symptoms suggestive of cystitis are frequent and painful urination, and the passage of urine containing pus (pyuria). If the reaction of the urine is alkaline the condition is almost certainly cystitis; if acid it may be pyelitis. In chronic cases where there is doubt the diagnosis may be made by direct inspection of the mucous membrane through the cystoscope or by catheterization of the ureters.

Treatment.—The prophylactic treatment of cystitis is of great importance. The bladder should be emptied at regular intervals, and false modesty or carelessness should not be allowed to interfere, as it frequently does in young girls. Special care in the use of the catheter, as mentioned above, is essential. Carelessness in this respect should not be encouraged by the stories of patients

Who have performed the operation on themselves for years without precaution, as such persons have unusual resistance which cannot be counted on by the nurse or physician.

The medical treatment of cystitis in the acute cases consists in the administration of mild diuretics such as potassium citrate, sedatives such as belladonna and hyoscyamus, demulcents such as flaxseed tea and uva ursi, and antiseptics such as urotropin and sodium benzoate. In subacute and chronic cases local stimulants, of which oil of sandalwood and copaiba are types, are also employed. Local treatment consists in irrigation with salt solution, boric-acid solution, silver-nitrate solution, etc. It is conveniently carried out by means of a catheter, a long rubber tube and funnel, and a connecting cannula. Frequently it is desirable to retain the silver solution in the bladder for some time (*e. g.*, twenty minutes). For this purpose as well as for irrigation a two-way catheter is convenient. Topical applications through the cystoscope or operations fall within the domain of the surgeon or gynecologist.

Pyelitis.—Pyelitis or inflammation of the pelvis of the kidney, may be due to an "ascending" infection, to infection through the blood, to tuberculosis, or to stone. In many cases of purulent pyelitis the kidney becomes riddled with small abscesses or is entirely disorganized (pyelonephritis). The urine in pyelitis is increased in amount, acid in reaction and contains pus cells intimately mixed (cloudy). The albumin is more abundant than in cystitis and there may be a few casts. In the tuberculous variety admixture of blood is frequent and tubercle bacilli are found (catheterized specimens). In mixed infections hectic fever with sweats is a characteristic feature. There may also be tenderness over the affected kidney (this is very usual in nephritis). Pyelitis may be unilateral or bilateral. By catheterization of the ureters it is possible to determine whether one or both kidneys are involved and what degree of function is retained in each. For

this purpose certain dyestuffs (indigo-carmin or phenol-sulphonaphthalein) are employed as described at the beginning of the chapter, but the urine is collected from each kidney separately by catheterizing the ureters.

Treatment.—The medicinal treatment is on the same principles as that of cystitis. Local treatment is only possible in exceptional circumstances. The operative treatment includes drainage or excision of one of the kidneys. The latter operation is only admissible when the presence of a normal organ on the opposite side has been ascertained.

Stone.—Stone in the kidney and in the bladder is not as common in this country as in some other lands. It is said to be especially frequent in the Orient (China). Kidney stones consist in whole or in part of uric acid, phosphates, lime salts, etc., and are of varying density. They increase in size like snowballs by the deposition of successive layers of the various salts. In the kidney the stones may be large enough to occupy the whole pelvis, accurately fitting every little projection and cavity. Such stones resemble branched coral. With or without these larger masses there may be numerous smaller calculi, some of them small enough to find their way through the ureter. The smallest fragments are called gravel. Kidney stones may form the nucleus of large calculi in the bladder or the latter may arise *de novo*. In the presence of stone in the bladder urination is frequent and painful, the distress being often referred to the mouth of the urethra. Sometimes the flow of urine is suddenly checked by some change in position of the stone or the urine may contain blood. The stone can sometimes be felt by a metal sound or demonstrated by the *x*-rays. The treatment is surgical.

The presence of stone in the kidney is suggested by dull pain and tenderness in the loin, the passage of bloody urine, and attacks of colic. In colic, whether following exertion or independent of it, agonizing pain radiating from the lumbar region to the bladder and urethra is

typical. There is a constant desire to void urine. With these distinctly urinary symptoms are associated nausea, vomiting, cold sweats, faintness, and collapse. Finally, after some hours the stone either passes or falls back into the pelvis with prompt relief of the pain. The stone may become impacted in the ureter and lead to successive attacks of colic, or cause permanent obstruction with hydronephrosis. In this condition the urine is dammed back distending the pelvis and ultimately causing atrophy of the kidney. After the attack the urine should be carefully watched for large calculi, or filtered through gauze to catch minute stones. The diagnosis of stone in the kidney can, as a rule, be confirmed by the x -rays. Very small or soft stones may not cast a shadow.

Treatment.—The treatment of stone in the bladder is surgical. The calculus may be either crushed or removed by perineal or suprapubic lithotomy. Mild antiseptics, sedatives, and diuretics may be used to relieve symptoms or to improve the condition of the urine. In renal calculus similar medicinal measures, a bland diet, and an abundance of pure or distilled water may diminish the frequency of acute attacks and perhaps limit the growth of the calculus. It is impossible to dissolve the calculus by drugs. In aggravated cases, if the age and condition of the patient permit, the stone(s) may be removed by incision into the kidney (nephrotomy). The attacks of colic will require the free use of morphin and atropin hypodermically, hot stupes, hot baths, etc.

Tumors.—Tumors of the kidney also cause pain and bloody urine ("tumors, tuberculosis, stone"). The commonest variety is peculiar to the kidney and is known as hypernephroma. It gives rise to metastasis, frequently to secondary growths in the lung. These tumors are malignant and only amenable to operation in the early stages.

Large benign cystic tumors are of occasional occurrence; these, though congenital in origin, increase in size in after-life. They consist of a great mass of cysts of all sizes

and of the most varied colors like a crazy quilt. I have removed a pair at autopsy either of which would equal an adult's head in size (average weight slightly over four pounds). They produce remarkably little disturbance considering their size and the "apparent" total destruction of kidney tissue.

Abscess.—Abscesses in the neighborhood of the kidney (perinephritic abscesses), whether due to injury or other causes, are frequently mistaken for disease of the kidney itself. They require surgical treatment, that is, incision and drainage.

Movable Kidney.—Movable kidney and floating kidney are varying degrees of the condition designated as nephrop-tosis. In this affection the kidney (usually the right) may be felt below the edge of the ribs, or it may "float" freely in the abdominal cavity. Movable kidney is associated in many instances with ptosis of the stomach and colon (*q. v.*). It may occur independently, however, in persons who have lost a great deal of weight, or in women who have borne many children. If the kidney is freely movable the ureter may become twisted, causing attacks of intense colicky pain similar to renal colic. Usually floating kidney produces merely a sense of weight or a dull, dragging pain in the lumbar region on the affected side.

Treatment.—The treatment of the freely floating variety with crises of severe pain should be surgical, fixation by a suture, etc. In the variety associated with gastrop-tosis the measures recommended for that condition usually suffice and operation is now only undertaken in rare and aggravated cases. The medical treatment consists in rest, overfeeding, and support by belts or special corsets.

Nephritis and Uremia.—Nephritis is commonly called Bright's disease in honor of the English physician who first noted the association of dropsy and albuminuria with disease of the kidneys. We now know that dropsy is not an invariable accompaniment of nephritis, though a small amount at least is usually to be detected (puffy

eyelids). Under nephritis we include one acute and several chronic forms. The acute variety and the corresponding chronic type are designated as parenchymatous nephritis. This term implies that the essential secreting tissue is primarily attacked. At autopsy, in the acute parenchymatous form, the kidneys are often swollen and congested, in the chronic form, large and white. Dropsy is usually marked, and albumin and casts abundant. In the chronic interstitial type the supporting or connective tissues were formerly thought to be primarily affected, though at present the process is more commonly considered as diffuse, that is, involving all the structural elements of the kidneys. At autopsy, in typical cases, the kidneys are small, shrunken, studded with minute cysts, and externally granular. In these cases dropsy is usually slight, albumin scanty, and casts few. The quantity of the urine is increased, the blood-pressure is often high, and uremia is common. Somewhat similar to this type is the kidney of arteriosclerosis, and the indurated kidney resulting from the long-continued passive congestion of chronic heart disease. The "type" cases of chronic nephritis are distinctive enough, but intermediate forms are often puzzling. It is common, *e. g.*, for an acute nephritis to be engrafted upon a chronic form, so that features of both may be present.

In insufficiency of the kidneys there is a retention of certain substances in the blood, which under normal conditions are picked out and eliminated by these organs, and also a resulting toxemia which expends itself largely on the nervous system. This state is known as uremia, and is often the cause of death in chronic Bright's disease. Chemical examination of the blood shows a great increase in the amount of urea and similar waste products, but since urea is not poisonous, when injected subcutaneously, the cause of uremia is still in doubt, in spite of more or less constant research in the seventy-five odd years which have elapsed since Bright first recognized the signs and symptoms of nephritis. Uremia may be acute

in its onset with convulsion and coma, or subacute or chronic with headache, mental hebetude, dyspnea, etc. The commonest manifestations of uremia are headache, vertigo, delirium, convulsions, transient paralyses, Cheyne-Stokes respiration, asthma, vomiting, and diarrhea. Very often it is impossible, without an examination of the urine, to distinguish a uremic from an apoplectic attack. Rarely we see cases in which an uncontrollable diarrhea is the most striking symptom. Uremia is always a serious

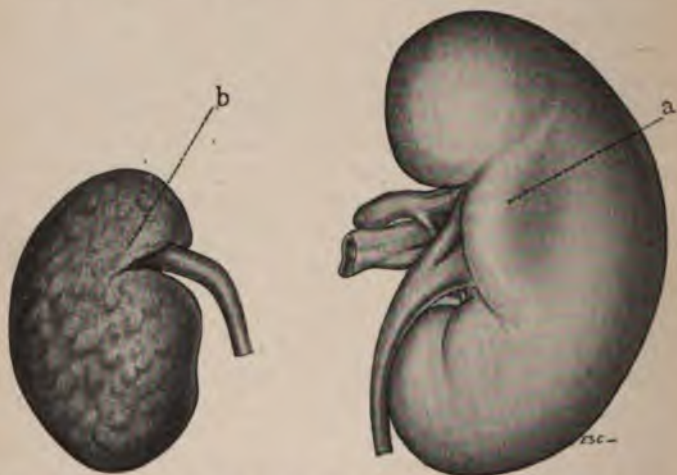


FIG. 48.—Large white (a) and small granular (b), contracted kidneys (one-half natural size), showing relative size. (Adami and McCrae.)

development in nephritis, but recovery is not unknown and patients frequently pass through a number of attacks before succumbing. The ultimate prognosis is bad.

Acute Bright's disease is due to a multiplicity of causes, and above all to the poisons of the specific infections. In scarlet fever it is so common that the prophylaxis against nephritis constitutes an essential part of the after-treatment of that disease. Poisons, other than those of the infectious diseases, such as cantharides, may have a

selective action on the kidney. There remains a group for which we can at present assign no better cause than "cold." A form of acute Bright's disease, known as "trench nephritis," has prevailed extensively during the present war. The onset is sudden, the dropsy well marked but the outcome usually favorable.

Acute nephritis is insidious in its onset; edema and pallor may be the first symptoms to attract the attention of the patient or his family. In addition there may be slight malaise, headache, nausea or other dyspeptic symptoms and scanty, red, or "smoky" urine. On examination the urine contains a large quantity of albumin, red blood cells, and casts of all varieties. Pain in the back is not a common manifestation, contrary to popular opinion, and is more suggestive of lumbago, stone or abscess than of nephritis. Severe cases may begin with convulsions (uremia) or acute suppression of urine. Though relatively acute in comparison with chronic nephritis, the disease is likely to last for a month or two, at least, and may end by death, by recovery, or by the development of chronic nephritis.

Chronic nephritis, of the so-called parenchymatous type (large white kidney), is very similar in its manifestations but more prolonged in its course. The face is pallid and puffy, especially about the eyes, and the subcutaneous tissues are edematous wherever their loose structure favors the accumulation of fluid. The serous cavities (pleuræ, pericardium, and peritoneum) often contain free fluid. The urine resembles in a general way that of the acute variety with an abundance of albumin and many casts.

In the chronic interstitial form (granular, contracted kidney) the symptoms are quite different, although the types sometimes blend in a confusing manner. This type is seen in persons with cardiovascular disease, in the aged, in the syphilitic, and in the victims of chronic poisoning (lead and possibly alcohol). Very often it develops without apparent cause. The course is very chronic; often

the first symptoms to attract attention may be headache, failing vision, puffy eyelids, dyspepsia, "asthma," polyuria, itching (eczema), or distinct uremic manifestations. It is very common for patients to seek the oculist or stomach specialist before any trouble is suspected. In the eye the former may detect hemorrhagic or albuminuric retinitis. Frequently attention is called to the patient's condition by the discovery of high blood-pressure, which is so common as to be almost diagnostic in this disease. In the fully developed form most or all of the above symptoms may be present, the most characteristic being edema of the eyelids, failing vision, high blood-pressure, and the passage of large quantities of dilute urine containing a faint trace of albumin and occasional casts. As the disease progresses hypertrophy and dilatation of the heart with dropsy, or the manifestations of uremia assume a prominent place. In addition to cardiac failure and uremia, apoplexy and pneumonia play important parts as causes of death.

Treatment.—The treatment for each of the various forms of nephritis is similar in principle, but variable in practice, according to the conditions to be met. The diet is generally arranged to spare the eliminative powers of the kidney so far as possible. For this purpose protein is restricted and in severe cases limited to the forms found in milk and milk products, eggs, and vegetables. The "extractives" which are found in meats are thought to be more irritating than the protein itself. Difficulty in the elimination of nitrogen (protein) is most likely to be met with in chronic interstitial nephritis and in threatening uremia. In parenchymatous nephritis with dropsy there is more difficulty with salt and water. Some physicians hold a contrary view and administer sodium chloride (salt) and sodium carbonate by continuous enteroclysis. The pure milk diet is valuable because its proteins are easily dealt with and its content of salt is low. On the other hand, if given in quantities sufficient to meet the caloric needs it contains an excess of protein

and water, *e. g.*, four liters (quarts) of milk, yielding twenty-seven hundred and twenty calories, contain one hundred and forty grams of protein. The latter is more than twice the minimum requirement. A better diet would include a moderate amount of milk or cream with cereal foods. Except in the severest cases a diet can easily be selected from the ordinary bill of fare.

Elimination by other channels than the kidney is favored by a warm, dry climate, suitable clothing (wool), warm baths, and laxatives. The eliminative power of the skin has been grossly exaggerated, but may be encouraged by Turkish and Russian baths, by steam, hot-air, and electric-light cabinet baths, as well as by the ordinary warm bath as mentioned above.

Diuretics, apart from the less irritating varieties, are usually eschewed, except possibly in the late stages. The simplest are the citrates and acetates of potassium, the most active, caffeine, theobromin, and theophyllin. Bas-ham's mixture which combines tonic and diuretic qualities is an old favorite in this disease.

In the presence of complications active measures are essential. In uremia, hot packs, hot-air, and vapor baths serve as a useful purpose. Bleeding and intravenous injections of salt solution are of great value in occasional cases to eliminate and dilute the uremic poison.



PART VIII.

DISEASES OF THE MUSCLES, BONES, AND JOINTS.

DISEASES OF THE MUSCLES.

Myositis and Myalgia.

DISEASES OF THE BONES AND JOINTS.

Acute Arthritis.

Chronic Arthritis.

Villous Arthritis.

Arthritis Deformans.

Heberden's Nodes.

Spondylitis Deformans.

Monarticular Arthritis.

Rheumatoid Arthritis.

Infectious Arthritis.

Nervous Arthropathies.

Pulmonary Osteo-arthritis.

DISEASES OF THE MUSCLES.

Myositis and Myalgia.—Myositis implies an inflammatory affection of a muscle; myalgia merely a painful one. Cases with demonstrable inflammatory foci are rare except in surgical practice and in trichinosis (see Part X). In the latter disease there is intense inflammation about the invading parasites which subsides after they have become encapsulated. Muscular rheumatism is the commonest disease under this caption. We usually speak of it as myalgia because of the lack of definite evidences of inflammation. Masseurs, however, frequently find indurated areas and nodules with tenderness in the muscular and tendinous structures. To these cases the term myositis would apply. Myalgias affecting certain groups of muscles have received specific names, for instance, myalgia of the lumbar muscles is called lumbago, while intercostal "rheumatism" is designated as pleurodynia. The term rheumatism is a bad one because the disease

has no connection with acute articular rheumatism to which the name should properly be confined. It is well to remember in this connection that pain and tenderness in the muscles and tendons are not at all rare in joint disease (arthritis deformans). So far as we know myalgia is a local affection independent of general disease, induced by local chilling and overexertion. Some believe that there is an underlying "rheumatic" or "gouty habit."

An attack of lumbago, to use the commonest variety for an example, begins suddenly with intense cramp-like pain in the lumbar muscles, which is aggravated by movement and relieved by rest, pressure, or heat. There is seldom much, if any, constitutional disturbance. After persisting from a few days to a week or more, the pain is relieved, but the patient is often liable to repeated attacks upon severe exertion or exposure to cold or wet. If the muscles of the chest are affected there is severe pain on breathing or coughing, simulating pleurisy. In the neck the painful spasm of the muscles causes the head to be held stiffly and perhaps drawn down on the affected side. Myalgic pains also occur in the diaphragm, abdominal muscles, the extremities, and the scalp. In the latter situation a form of indurative headache has been described, characterized by the nodules previously mentioned.

Treatment.—Persons who are subject to attacks of myalgia should wear silk, wool (merino), or linen mesh underwear. Too heavy underwear is deleterious, as it leads to excessive perspiration and invites chilling. In view of the possibility of intestinal toxemia, attention should be given to regularity of the bowels. In an attack the local treatment is the most important. Except in mild attacks the patient should be confined to his bed, as a uniform temperature combined with rest hastens recovery.

All the ordinary local applications have been used in this disease with more or less success, *e. g.*, acetic acid, blisters, mustard and belladonna plasters, liniments of

every variety, salicylic acid, and other ointments, dry cups, etc. Heat has been applied by mud and flaxseed poultices, hot stupes, the tailor's "goose," and baking. The most effectual measures are strapping in the acute stage, and massage as the disease subsides. The adhesive straps should be applied to splint the affected part and not with any idea of introducing medicinal substances (belladonna). In the lumbar region this object is best attained by applying broad overlapping strips like clapboards. During the application the patient should bend backward as far as possible, as this will make the straps firmer when he resumes a normal attitude. In the nodular variety massage alone may effect a cure, but it is beneficial in all forms, after the acute stage, if the patient's pocket-book will permit of its use. Internally salicylates (aspirin), sodium bicarbonate, ammonium chloride, and in the later stages nux vomica are commonly prescribed.

DISEASES OF THE BONES AND JOINTS.

Acute Arthritis.—The most important form of acute arthritis is acute articular rheumatism, which is described under the infectious diseases. Acute joint symptoms may be found in a number of infectious diseases, such as septi-cemia, influenza, dysentery, scarlet fever, etc. Some of these cases may terminate in suppuration or lead to permanent joint changes. Local injury or infection also leads to acute arthritis (synovitis); this type is considered in books on surgery. The same is true of the irritative joint symptoms, brought about by flat-foot, sacro-iliac disease, and other orthopedic conditions.

Chronic Arthritis.—In chronic arthritis there is almost always more or less extensive change in the synovial membranes, joint cartilages, or bones. In this respect it differs from true rheumatism (acute and subacute) which does not injure the joints permanently. Mild types of chronic arthritis (joint inflammation) are com-

monly described as chronic articular rheumatism, but the designation is not so popular as formerly because it is admittedly misleading. Most people think that it is a chronic form of acute articular rheumatism, whereas there is no connection between the two. Some of these cases may be gout, but many of them are mild cases of arthritis deformans.

Villous Arthritis.—A variety of "chronic rheumatism" which is known as villous arthritis or "dry joint" attacks the large articulations (shoulders, knee, etc.), and is characterized by pain, stiffness, and soft grating. The latter is easily felt when the joints are manipulated. This "crepitation" is due to fringe-like folds of synovial membrane projecting into the joint cavity. Sometimes these fringes are caught between the bones, causing exquisite pain; at other times bony spicules may be present which irritate the joint in certain positions, and account for the attacks of pain and effusion. Since the joints are relaxed they are improved if supported by straps or elastic hosiery. Similar symptoms are often observed in young men (athletes) who have dislocated the semilunar cartilages of the knee. This accident causes sudden sickening pain and effusion of fluid.

Arthritis Deformans.—The more extreme degrees of arthritis, most of them accompanied by bone changes, are grouped under the title of arthritis deformans. In some of these cases the joint and adjacent bony structures are wasted (atrophy), in others there is overgrowth (hypertrophy). If the bones are extensively involved the term osteo-arthritis is applicable. The four types described below are the most important.

Heberden's Nodes.—Heberden's nodes are little bony nodules at the bases of the terminal phalanges of the fingers and toes. As they increase in size they restrict the movements of the terminal joints, and eventually the latter may become partially dislocated to one side or the other, or even ankylosed. These nodes are common in persons past middle life and seldom lead to any serious

disability. In the earlier stages the small joints may be tender and swollen from time to time.

Spondylitis Deformans.—Another form of arthritis in which hypertrophy predominates attacks the joints of the spinal column (spondylitis). Adjoining vertebræ become lipped by bony outgrowths, or the whole anterior surface of the spinal column is plastered over with new bone. The ultimate result is complete ankylosis of the joints and rigidity of the spine. Sometimes the disease may extend to the hips and shoulders. The patient may complain at first of stiffness and pain in the back on movement. The pain is severe and often radiates along the course of the spinal nerves, some of which may be pressed upon and irritated by the bony outgrowths. Even at an early stage the back may be absolutely rigid, but this is due in part to muscular spasm and may disappear almost entirely with treatment. The normal curvatures of the spinal column are obliterated ("poker back") and the head is held stiffly and cannot be rotated more than an inch or so in either direction, if at all. If the hips are ankylosed the patient is absolutely helpless. With treatment there may be temporary improvement, but the course of the disease is usually progressive until the spine is locked. After this the patient may remain *in statu quo* for a long period of years. In some cases the disease is confined to certain regions—the neck, the back, or the lumbosacral region. A slight degree of arthritis of the spine is almost normal in the aged, but the cases we have been describing often develop in the prime of life.

Monarticular Arthritis.—In the aged arthritis of the large joints with atrophy may lead to considerable disability. The hip and knee are the joints usually affected. In the former case the head of the bone becomes flattened like a mushroom and the joint cavity shallow. On account of the destruction of the cartilage there is grating, while the overlapping or lipping of the edges of the joint causes great restriction of movement. Usually one joint only is affected. The symptoms are pain, stiffness,

and lameness. The weakening of the joint predisposes to intracapsular fracture (hip).

Rheumatoid Arthritis.—Rheumatoid arthritis is characterized by a chronic, progressive course, with atrophy and deformity of many joints (hence the term chronic, progressive, polyarticular arthritis). It is accompanied by wasting of the muscles and atrophy of the skin. The disease was formerly thought to be due either to disturbances of metabolism or to disease of the nervous system with trophic changes. The tendency at the present day is to attribute these cases to chronic toxemia, the result of some cryptic (hidden) or apparently trivial infection. The following are examples of such infections: pyorrhea alveolaris, sinus disease, pyelitis, and chronic endometritis. This theory has the advantage that it offers a reasonable basis for therapeutic attack in many cases which would otherwise be beyond the reach of medical treatment. Rheumatoid arthritis may begin acutely and frankly (being at first indistinguishable from acute articular rheumatism), or it may be chronic and insidious from the beginning. In either case periods of activity, with fever, pain, and swelling of the joints, alternate with intervals of comparative freedom. The small joints are more particularly involved, and during the inflammatory stage assume a peculiar spindle-like form due to the infiltration of the soft parts. With each succeeding attack the deformity becomes more and more marked, but finally after a term of years the disease reaches a stationary, quiescent stage, leaving the victim partially or completely crippled. In the advanced stage the hands are crumpled and distorted, the small joints of the fingers are ankylosed, and the hand is turned strongly to the ulnar side (toward the little finger). If the patient has been confined to bed the hips are fixed at a right angle and the knees bent. The elbows are also frequently ankylosed so that the patient cannot comb his hair or feed himself.

The disease, though common at all ages, begins, as a

rule, in the prime of life and drags along into old age. Our hospitals, homes, and almshouses harbor scores of these unfortunate patients (chiefly females). In children there is a special form distinguished by more acute symptoms and by enlargement of the glands and spleen.

Infectious Arthritis.—The types of chronic arthritis which we have been considering hold an obscure, although an important, relation to infection. In other types the symptoms may be almost identical, but the relation to infection may be quite frank. The permanent joint changes which may follow acute infectious arthritis have been alluded to above. The following infections are



FIG. 49.—Hands showing marked late deformity. (McCrae.)

prone to lead to subacute or chronic arthritis: gonorrhea, tuberculosis, and syphilis.

Gonorrheal infection may attack one or more of the larger joints or certain small joints (*e. g.*, the articulations of the jaw and clavicle). The symptoms are at first acute—fever, pain, tenderness, redness, and effusion—but later become subacute or chronic. (See Part X.) Tuberculous arthritis (“white swelling”) is very characteristic in its manifestations. It involves most frequently the spine (Pott’s disease), the hip, the knee, and the elbow. The treatment is purely surgical, but the disease is important from a medical point of view, since a latent

hip or Pott's disease may give rise to meningitis or miliary tuberculosis. Syphilis also attacks the bones and joints, particularly the former. Necrosis of the bones of the skull is common, sometimes with loss of substance and consequent deep depression in the forehead. The fingers may be diffusely enlarged like spindles (dactylitis), but the commonest situation for syphilitic bone disease is in the legs. The tibiae are frequently enormously thickened, rough, and in children bowed anteroposteriorly like saber blades. During the acute stage the bone and its investing periosteum is very tender. A form of syphilitic arthritis, similar in its manifestations to articular rheumatism, is also described.

Nervous Arthropathies.—In nervous diseases, and above all in tabes, severe destructive joint disease occasionally takes place. The knees are most often affected. The disorder is attributed to trophic disturbances (nervous arthropathy).

Pulmonary Osteo-arthropathy.—Hypertrophic pulmonary osteo-arthropathy or clubbing of the fingers is seen characteristically in chronic ulcerative tuberculosis, bronchiectasis (dilatation of the bronchi), and empyema. The ends of the fingers are large and bulbous and the nails are curved like tortoise shells. There is also thickening of the phalanges. The clubbed fingers of congenital and chronic heart disease are similar in character.

Treatment of Chronic Arthritis.—In the acute stages of arthritis salicylates are of use to relieve pain but do not exert any curative effect on the lesions. As a matter of fact they are injurious insofar as they interfere with digestion and nutrition. Phenacetin may also be used for the same purpose but with greater caution. Locally, at the same stage, evaporating lotions, magnesium sulphate in saturated solution, raw cotton, and similar dressings are of use. In the more acute forms and in infectious arthritis splints at times give considerable relief. In infectious arthritis incision into and drainage of the joint is sometimes necessary. The diet, if there is fever, may

be moderately restricted, but in the intervals it should be generous, with an abundance of fat and protein (meat, eggs, and milk).

After the acute attack is over or in cases in which the disease is chronic from the outset, the articulations should be manipulated daily and the patient, as soon as he is able, should be encouraged to make as full use as possible of all the muscles and joints. This will tend to prevent distressing contractures which so frequently cripple these patients entirely and prevent them from walking or even from feeding themselves. I have seen remarkable improvement in the use of the hands and arms following a prolonged course of passive movements, exercises, and massage. Baths are not of much use; occasionally patients derive benefit from sulphur springs, or at home from alkaline baths. In rare cases ankyloses in vicious positions may be improved by forcible manual correction under ether or by operation.



PART IX.

DISEASES DUE TO HEAT AND OTHER PHYSICAL CAUSES AND TO POISONS.

PHYSICAL CAUSES.

Sunstroke.

Heat Exhaustion or Other Effects of
Heat.

Caisson Disease.

POISONS.

Alcohol and Alcoholism.

Opium Poison and the Opium
Habit.

Cocain Habit.

Lead Poisoning.

Food Poisoning.

Auto-intoxication.

Arsenic, Mercury, Antimony,
Phosphorus, etc.

Atropin and Strychnin.

DISEASES DUE TO PHYSICAL CAUSES.

Sunstroke.—Sunstroke or insolation results from excessive heat and exposure to the direct rays of the sun. Alcoholic excess is a predisposing cause. It is common in hot climates or at midsummer in the temperate zone, and attacks those whose duties keep them in the open. It occurs with special frequency, for example, at army maneuvers when large numbers of unseasoned recruits are exposed to the direct rays of the sun. In this climate the majority of cases are observed during the few days or weeks of midsummer when the temperature in the shade exceeds 90°.

The patient may have premonitory symptoms such as headache, dizziness, and nausea. The onset is usually sudden with loss of consciousness and complete coma. Convulsions sometimes occur.

Symptoms.—When the patient is admitted to the hospital the skin is red, hot, and dry, the pulse rapid, full, and strong, and the temperature extremely high— 108° , 110° or more. If the temperature is allowed to continue at this height, there will be irreparable damage to the nervous system, but the prompt use of cold baths will usually reduce it rapidly and the patient will pass into a refreshing sleep. From this he may awake showing comparatively slight signs of illness. In many cases death occurs without reduction of temperature as the result of damage to the vital centres; in other cases a condition of collapse precedes the fatal outcome. A patient who has suffered from sunstroke is frequently subject to severe headaches, due perhaps to chronic thickening of the meninges, and is liable to subsequent attacks of insolation.

On excessively hot days, when cases of sunstroke are being hurried into the receiving tent, other diseases accompanied by high fever and unconsciousness are liable to cause confusion. I have seen patients (Fig. 54) treated by "ice baths" in whom subsequent examination of the blood revealed the presence of malarial parasites. In these instances the mistake was fortunately a harmless one.

Heat Exhaustion and Other Effects of Heat.—Heat exhaustion occurs in persons who have been exposed to prolonged high temperature and humidity in ill-ventilated work-rooms, factories, holds of ships, etc. The patient is prostrated, but may be conscious, the color is pale or cyanotic, the skin cold and "leaky," and the pulse small and feeble. In fatal cases death occurs in collapse.

Persons who are exposed to the direct effects of very high temperatures, such as stokers, firemen, and iron-workers, sometimes develop intense cramp-like pain in the legs, with spasmodic contraction of the calf muscles. The common limitation to the lower extremities is probably due to special exposure.

After prolonged residence in the tropics, natives of the temperate zone, particularly women and children, suffer

from anemia, loss of appetite, poor nutrition, and general weakness and lassitude. Some physicians who have had large experience in the tropics believe that the intense light, independently of the heat, is in itself deleterious to blond races.

Treatment.—Cases of sunstroke should be given cold baths to reduce the temperature as promptly as possible. Although these baths are popularly described as ice baths the temperature of the water does not fall below 65° or 70° in spite of the free addition of ice. The patient should be rubbed vigorously while in the bath to encourage radiation of heat from the surface of the body, and an ice-cap should be applied to the head. The patient should be removed from the tub before the temperature reaches normal, as the fall is likely to continue after removal. In heat exhaustion, on the other hand, heat should be applied to the feet and body by hot-water bags and bottles and free stimulation should be employed as well as aromatic spirit of ammonia, strychnin, atropin, etc. Cases of sunstroke and heat exhaustion are usually treated in tents rather than in hospital wards. If the tents are well ventilated, which is not always the case, they are much cooler than the wards at night. In the daytime they present no advantages beyond free ventilation and greater convenience. Those residing in the tropics require an annual vacation in a colder climate. Officers and civilians in the Philippines often go to Japan; in India the Europeans seek the foot-hills of the Himalayas.

Caisson Disease.—Compressed and rarefied air may cause unpleasant or even dangerous symptoms. In caissons, which are sunk for the purpose of constructing bridge piers, etc., beneath the water, pressure is used to exclude water from the workings. At the depth of one hundred feet this may amount to fifty to sixty pounds to the square inch. The workmen gain access to the working chamber through intermediate compartments in which the pressure is raised. By gradually increasing the pressure when going in and still more gradually (one-half

to one and one-half hours) decreasing it when coming out, injurious symptoms may be avoided; otherwise caisson disease or the "bends" may arise. This affection is characterized by pain and cramps in the limbs, or paralysis. In some cases death follows. Divers are exposed to the same dangers when working at great depths.

The rarefied air of high mountains and plateaus frequently causes disturbances of the respiration and circulation in those suffering from cardiovascular disease, or in normal persons who overexert themselves. Nosebleed is a common symptom. These symptoms are probably due to deficiency of oxygen in the rarefied air. Physicians are loath to send patients with myocardial disease to lofty altitudes, particularly if the transition from the lower to the higher level is abrupt.

POISONS.

In this section only those poisons which give rise to well-marked clinical pictures or lead to inveterate habits will be considered. For a complete list of the several poisons and their antidotes the reader is referred to books on "materia medica," "first aid," "emergencies," etc.

Alcohol and Alcoholism.—Ethyl alcohol is the essential constituent of all fermented beverages and distilled liquors. It is one of a series of alcohols, which includes methyl or wood alcohol, amyl alcohol and many others less well known. Alcohol is closely allied to the carbohydrates (sugars and starches), but theoretically has a much higher fuel value, the factor being seven calories per gram as compared with four for carbohydrates (see Part VI). A controversy has raged for many years between those who assign a food value to alcohol and those who regard it as a poison pure and simple. Conservative opinion inclines to the view that small quantities may be utilized with profit for the production of heat and energy under certain conditions, for example

in diabetes and in exhausting fevers (sepsis and typhoid). As a stimulant alcohol is now much less favorably regarded than formerly. Its principal action is to dilate the superficial bloodvessels inducing a full, soft pulse. As a heart stimulant it is ephemeral in action and may be classed with aromatic spirit of ammonia. For these and other reasons the prescription of alcohol for medicinal purposes has been greatly restricted in the last ten to fifteen years.

The effect of the prolonged use of alcohol on the various organs and tissues is to some extent a matter of dispute. Some authorities, though fewer than formerly, believe that small quantities well diluted produce no deleterious effects, even when long continued. In larger amounts and in concentrated solution (spirit) there is no question but that alcohol causes catarrh of the gastro-intestinal canal and cirrhosis of the liver. The writer has rarely seen a case of uncomplicated gastritis in which alcohol has not played a major part. To judge from the histories of our patients, the effect of alcohol on the kidneys and cardiovascular system seems to be hardly less striking. Statistical inquiries appear to show, however, that it is not an important cause of arteriosclerosis. Alcohol is a direct cause of certain forms of insanity (toxic) and is thought to be an indirect cause, not only of insanity, but of many nervous diseases.

Acute alcoholism is too familiar a condition to require description. It does not lead to delirium tremens, alcoholic neuritis, or other serious complications, unless the bout is unduly prolonged, or the acute excess associated with chronic overindulgence. Its chief importance in internal medicine is as a predisposing cause of pneumonia and rheumatism on account of the incidental exposure. At times there is some difficulty in distinguishing acute alcoholism from opium poisoning, apoplexy, uremia, diabetic coma, and "status epilepticus." Mistakes are most likely to happen in ambulance and police work, with scanty histories and small opportunities for careful examination. When treatment is necessary the most effectual

mode of relief is the administration of a hypodermic injection of apomorphin hydrochloride, or better still, lavage of the stomach.

Chronic alcoholics are of two general types—those who indulge in moderately large or excessive quantities (a pint or more daily), continuously or almost continuously, and those in whom periods of excessive indulgence alternate with periods of complete abstention from, and even disgust for alcohol. The latter type is undoubtedly in the nature of a psychosis. The former includes many persons who drink from wilful choice, and not because of any imperative impulse.

Persons who drink steadily may show very few signs of alcoholic excess, perhaps a little squeamishness in the morning, tremor of the hands, etc., but if they are attacked by acute disease or suffer from some injury severe enough to confine them to bed, they are prone to develop delirium tremens. I have seen this most often in pneumonia and in fractures of the lower extremities. Chronic periodical drinkers and alcoholic subjects generally after a prolonged spree may also develop delirium tremens. The symptoms most suggestive of impending delirium tremens are anorexia, tremor of the hands, tongue, and lips, restlessness, and obstinate insomnia. The tongue is heavily coated and often dry and brown. The characteristic delirium has been described previously (see page 27). The patients are often difficult to control and struggle violently to escape from their terrifying hallucination. If they can be induced to sleep, they frequently awake refreshed and prompt recovery occurs. Other patients exhaust themselves and die of asthenia, while still others pass into a state of semistupor which may persist for weeks (alcoholic wet brain).

Neuritis, gastritis, cirrhosis of the liver, bronchitis, and bronchopneumonia, are complications of alcoholism which are described in their appropriate sections.

Treatment.—The curative treatment of chronic alcoholism under ordinary conditions is not hopeful. At the

Philadelphia General Hospital we have patients who have been admitted for alcoholism more than one hundred times and many others with records almost equally bad. Periodic drinkers in any class of society are most difficult to cure and only do well when under institutional care, or when far removed from any probability of temptation. Ordinary alcoholism is more susceptible to improvement if the coöperation of the patient is assured and if the influences which surround him are helpful. In hospital work most of the patients have no desire to be cured and the conditions by which they are surrounded at home are all conducive to a continuation of the habit. Many systems of treatment for the cure of chronic alcoholism have been proposed, most of them unfortunately tinged with more or less quackery. A common and legitimate method is by institutional supervision and by the prolonged use of full doses of atropin and strychnin.

In threatening delirium tremens free lavage at the beginning may ward off serious symptoms. Delirium tremens is sometimes treated as an "acidosis" by intravenous injections of sodium bicarbonate solution. (See Diabetes.) Once these have appeared sedatives and physical restraint become necessary. It is very common, however, for patients to be overdosed with hypnotics or injured by too strict restraint. If there are enough attendants to control the patient it is better to avoid handcuffs and restraining sheets altogether. Sometimes patients are kept quiet by continuous full baths at body temperature. Lumbar puncture is also an effective measure under some circumstances. The sedative drugs most in use are: bromides, paraldehyde, chloral, hyosin, and morphin. Physicians differ as to the wisdom of stopping the alcohol immediately, or cutting it off gradually. Stimulants such as strychnin and digitalis are necessary for most patients at one stage or another. The diet in the acute stage is perforce liquid, but must be as nourishing as possible, *e. g.*, milk and eggs.

Wood alcohol will produce an acute intoxication not

unlike that due to ordinary alcoholic beverages, but chronic poisoning by this substance is much more serious, as even moderate doses may cause atrophy of the retina, and partial or complete blindness. Poisoning may be due to the fraudulent substitution of wood alcohol for grain alcohol in whisky and other liquors, or toppers may deliberately make use of it when other supplies are exhausted. Even external applications made from wood alcohol, *e. g.*, cheap hair tonics, have been known to induce ocular changes.

Opium Poisoning and the Opium Habit.—Acute opium poisoning is most frequently due to morphin or laudanum. These may be taken in overdose by mistake or with suicidal intent. The leading symptoms are somnolence, stupor, slow respiration, stertor, and pin-point pupils. The respiration may fall to 10 to 12 or less and if the patient is allowed to sleep, may stop entirely.

Treatment.—The treatment consists in getting rid of the drug so far as possible by repeated lavage (because morphin is eliminated into the stomach even when taken subcutaneously), in the administration of moderate doses of atropin and caffein (coffee) to antagonize the effects of the opium, and in the prevention of sleep. The latter object is usually attained by walking the patients, by flipping with a towel, by the electric brush (painful), and by alternate hot and cold douches. Walking and whipping, used without judgment, sometimes cause death from physical exhaustion. On the other hand, I have seen excellent results, without harmful incidental effects, following the use of electricity, hot and cold water, etc.

Opium Habit.—The opium habit is induced by the above-mentioned preparations, by opium itself, by laudanum, by paregoric, by heroin, and rarely by codein. Opium is smoked, paregoric and laudanum are taken by the mouth, morphin is usually taken by hypodermic injection, and heroin is used as a snuff. Indulgence in opium (smoking) and heroin, and to a less extent in morphin,

may be a purely vicious habit; many cases of morphin addiction, however, follow the prolonged therapeutic use of the drug for pain and discomfort. Nurses as well as physicians are likely to acquire the habit if they prescribe for their own aches and pains. It should be an invariable rule with the nurse never to take a dose of these and similar drugs without a specific order from a physician.

The opium habit is quickly acquired and difficult to shake off. The drug gives a sense of well-being with dreamy visions and freedom from pain, but increasing doses are required to get an effect. As much as a dram a day may be taken without fatal results. In the intervals between doses the patient suffers from gastro-intestinal symptoms, irritability, restlessness, and insomnia. These symptoms are vulgarly designated as the "habit." If the drug is withdrawn entirely there may be intense physical and mental distress, particularly vomiting, diarrhea, intestinal colic, tremor, and delirium. After prolonged or excessive use anemia and emaciation develop. In elderly persons using moderate amounts there may be no unpleasant symptoms.

Treatment.—The opium may be withdrawn immediately or gradually. During the first few days of treatment the patient suffers intensely from nausea, vomiting (green) and insomnia. It is necessary to have the patient in an institution, otherwise he will obtain supplies by stealth, as most opium habitués cannot be trusted. Dr. Lambert, of New York, has treated large numbers of cases successfully by active and repeated purgation with blue mass and compound cathartic pills, by the administration of belladonna and hyoscyamus, and by the gradual withdrawal of the drug.

Cocain Habit.—Cocain ("coke") addiction is even more deleterious than the morphin habit. It acquired a foothold largely through the use of the drug in nose and throat practice before its dangerous nature was known. The stringent laws that have been enacted are limiting its use so that cases of the habit are not very frequently

observed in hospital practice. It is usually taken as a snuff and is frequently combined with heroin.

Acute symptoms are sometimes seen after the use of the drug as a local anesthetic—rapid pulse, excessive restlessness, insomnia, and the like. The habitu  after his dose is said to experience a most delightful sense of satisfaction in his own ability, both mental and physical, but subsequently becomes irritable, morose, jealous, and vindictive. Terrifying hallucinations are common. The treatment is similar to that suggested for the opium habit. Immediate withdrawal of the drug is usually practised.

Lead Poisoning.—Lead is the most important of the industrial poisons. More than a hundred occupations have been known to occasion "plumbism." Those in whom it most frequently occurs are white-lead workers, makers of storage batteries, painters, smelters, plumbers, printers, etc. The large incidence of the disease in white-lead workers is to a great extent due to neglect of well-known precautions by the manufacturers, by the workmen, or by both. Poisoning may also occur from medicine ("lead and opium pills"), water contaminated from lead pipes, etc.

The principal manifestations of lead poisoning are: lead colic, lead anemia, lead palsy, and lead encephalopathy. The pains of lead colic are usually felt about the navel and are very intense. Obstinate constipation is associated with the pain. I have seen a case which simulated perfectly renal colic. There is a "blue" line near the free border of the gums, but this is absent when the teeth are missing. Anemia is rapid and severe and a peculiar granulation of the red blood cells is demonstrable by straining. The latter is very suggestive, but not in itself diagnostic of lead poisoning. Palsy may develop with or without preceding attacks of colic. Wrist-drop and foot-drop are the types of paralysis ordinarily seen, but multiple neuritis is possible. Recovery is the rule in lead palsy except in neglected cases. Other nervous symptoms occasionally seen are tremor, delirium, convulsions and

insanity. Lead is an important cause of arteriosclerosis, nephritis, and gout.

Treatment.—Prophylactic treatment is most important. White lead may be made by a wet process which does away with the dangerous dust, or the workmen may wear respirators (because of discomfort they seldom do). Good nutrition and the free use of milk is thought to be of value. Thorough washing of the hands before handling food is the simplest and most generally applicable precaution, though not sufficient in itself.

In a subacute attack with colic, rest, purgation by Epsom salt, morphin, and local applications (hot stupes, etc.), are of value. Later potassium iodide, in small doses, and iron are indicated. For lead palsy the same drugs are used perhaps with the addition of strychnin, and also local measures such as massage and electricity.

Food Poisoning.—Under this heading may be included toxic symptoms produced by food products of all sorts, fish, shell-fish, meats, milk and cheese, vegetable foods, etc. The symptoms may be brought about by the poisonous nature of the food itself, by "ptomaines" resulting from putrefaction, or by contaminating microorganisms introduced with the food. Examples of the first are poisonous fish, toadstools, and sprouting potatoes; of the second, decaying lobsters and cheeses; of the third, infected sausage, and shell-fish contaminated by sewage (see Typhoid Fever).

The general symptoms of ptomaine poisoning are those of acute gastro-enteritis: fever, severe pain, vomiting, purging, and collapse. Nervous symptoms may be prominent or there may be special symptoms, *e. g.*, gangrene in those who eat diseased rye (ergot).

Auto-intoxication.—Auto-intoxication ("self-poisoning") is a condition induced by the action of poisons formed within the body itself. The acid intoxication of diabetes is a good illustration of such an auto-intoxication. The term is more often, if less correctly, applied to vague symptoms which are presumably due to poisonous prod-

ucts formed in the intestinal tract by the action of putrefactive bacteria. An excess of indican in the urine is suggestive of excessive intestinal putrefaction.

The symptoms of the latter condition are indefinite—headache, vertigo, disinclination to work, flatulence, constipation, diarrhea. Treatment consists in dietetic restrictions of various kinds and in the administration of buttermilk or lactic-acid bacilli (*Bulgarian bacillus*).

Arsenic, Mercury, Antimony, Phosphorus, etc.—Arsenic, mercury, antimony, and phosphorus may give rise to chronic poisoning in those who have been exposed to these poisons at their work or who have received medicinal doses. Acute poisoning arises when large doses have been taken by accident or with suicidal or homicidal intent. Arsenic frequently causes slight gastro-intestinal and renal irritation, and less often multiple neuritis, when administered in large doses or over a prolonged period for syphilis (*salvarsan*), chorea, and pernicious anemia. Mercury under similar conditions causes ptyalism, loosening of the teeth, and gastro-intestinal irritation, but these symptoms are now infrequent except in susceptible persons. In former times when mercury was used with greater freedom they were very common. Antimony and phosphorus are seldom used in medicine and toxic symptoms are extremely rare. Industrial poisoning from mercury occurs in smelters, in chemical workers, in makers of physical apparatus, in hat makers, etc. It is said to cause tremor, painful convulsions without unconsciousness, and emotional disturbances. Chronic phosphorus poisoning is seen in match workers and may be prevented if the form of phosphorus known as red phosphorus is employed. In this country legal restrictions are at fault in this respect. Phosphorus workers suffer from a match-like taste in the mouth and if the teeth are carious from a destructive necrosis of the jaw. If the poisoning is more severe, acute fatty degeneration of the liver with jaundice may occur (usually fatal).

Acute poisoning due to arsenic and mercury is accom-

panied by severe irritation and inflammation of the gastro-intestinal tract. It is difficult to control and commonly fatal either immediately or ultimately. In the middle ages arsenic was a favorite with poisoners, on account of its tastelessness and insidious effects, but it has now lost its evil preëminence, if for no other reason, on account of the readiness with which it may be detected by the chemist. In most countries the use of arsenic in embalming is forbidden because of the danger of concealing the criminal use of the drug. Acute arsenical poisoning may be treated by immediate lavage and the administration of the antidote (ferric hydroxide with magnesium oxide, four ounces). Lavage should be repeated at intervals. Acute mercurial poisoning commonly results from the accidental or suicidal ingestion of bichloride of mercury tablets. If the patient survives the acute gastro-intestinal manifestations he is likely to succumb later from acute nephritis and uremia. Recovery is possible even after a whole tablet has been taken. The treatment consists of prompt lavage and the administration of milk and white of eggs.

Nitrate of silver administered continuously over a long period causes a ghastly bluish discoloration of the skin which is permanent. I once saw a patient with "argyria" in a syncopal attack. The resident physician in charge, supposing that he had to deal with a case of dangerous heart failure, made reckless use of hypodermics, but by good fortune did the patient no harm.

Atropin and Strychnin.—Atropin very commonly occasions toxic symptoms even in therapeutic doses. This is due in part to the varying susceptibility of different individuals. Serious results are rare because of the care with which the drug is employed and the distinctive character of the manifestations. I have seen marked dilatation of the pupils and rapid pulse after the use of an ordinary belladonna plaster. The writer once suffered from toxic effects, including in addition to the above, insomnia and

extreme restlessness, after drinking out of a beaker which had been used in the preparation of eye-drops.

Strychnin poisoning is characterized by severe tonic convulsions without loss of consciousness. In a case which I saw many years ago fatal asphyxia was induced by an attempt to wash out the stomach. Considering the reckless freedom with which the drug is used by all classes of persons the rarity of acute poisoning is remarkable.

PART X.

INFECTIOUS AND PARASITIC DISEASES.

CHAPTER I.

GENERAL CONSIDERATIONS.

| | |
|--------------------------------------|----------------------------|
| INFECTIOUS AND CONTAGIOUS DISEASES. | HOSPITAL QUARANTINE. |
| MODES OF TRANSMISSION IN INFECTIONS. | IMMUNITY. |
| CLASSIFICATION OF INFECTIONS. | ANTITOXINS. |
| CLASSES I, II, III, AND IV. | PHAGOCYTOSIS AND VACCINES. |
| COMMUNICABLE DISEASES. | VIRUSES. |
| PERIODS OF INCUBATION. | Summary. |
| PERIODS OF ISOLATION. | FEVER. |
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| | Thermometry. |
| | Treatment of Fevers. |

Infectious and Contagious Diseases.—Infectious diseases are caused by the lodgment and growth in the body of minute organisms which may be either animal (protozoan) or vegetable (bacterial) in their nature. Infestations with larger and more highly organized animal parasites (metazoa) are often considered apart, but for our purposes may be grouped with the infections proper, on account of the essential similarity in the means by which they are transmitted, and as a consequence in the methods of prophylaxis against them. Formerly a distinction was made between contagious and infectious diseases on account of supposed differences in mode of transmission. A contagious disease was thought to be transmitted not only by actual bodily contact with the

patient, or with secretions and excretions derived directly from him, but also by certain hypothetical "exhalations." Thus the atmosphere in the neighborhood of smallpox hospitals was supposed to be "catching." "Contagion" in this sense is probably a myth, as is also "infection" in the sense of a miasma arising from swamps. Present-day authorities prefer the terms *transmissible* or *communicable* to either of those mentioned, but the older terms will doubtless continue to be used—infectious in a broad comprehensive sense and contagious with a narrower significance, to define those diseases which are readily communicable by direct or indirect contact (measles, scarlet fever, diphtheria, and the like in contradistinction to tetanus, malaria, etc.).

Modes of Transmission in Infections.—Infection may be acquired (1) by direct contact with patients or infected animals; (2) by indirect contact; (3) through human or animal carriers; (4) through intermediate hosts; (5) by drinking-water; (6) by food; and (7 and 8) through the medium of the air or soil. Some of these expressions require explanation and amplification. Infection by direct contact implies close association with patients or infected animals or direct exposure to "contagious" discharges, etc. Infectious material is often borne in minute particles of moisture which are expelled by a patient in coughing, sneezing, and yawning—hence the term "droplet infection." Indifferent objects, such as bed and body linen (sometimes known as "fomites") which have been contaminated by discharges or excretions, may convey infection by indirect contact. Objects which have merely been exposed to air infection are probably very slightly dangerous, possibly not so at all. Dust infection may be considered a form of indirect contact. Thus dried up and pulverized excretions may still contain virulent microorganisms, as was long ago proved for tubercle bacilli and more recently for typhoid bacilli. Fortunately the disinfectant properties of air and sunlight reduce this danger to a minimum. It may be further dimin-

ished by the employment of damp sweeping and dusting, and vacuum cleaning. By the term "carriers" we designate (a) individuals who, following exposure to contagion, harbor dangerous organisms somewhere in the economy (throat, intestine, etc.), without being themselves attacked by the disease, and (b) persons who, having recently or long since convalesced from an acute illness, still distribute organisms from some persistent focus of infection. Diphtheria is commonly conveyed by persons of the first type who carry the causative bacilli in their throats; typhoid infection, on the other hand, is spread broadcast, through the contamination of food and water supplies, by persons whose excretions (feces and urine) contain typhoid bacilli for months, and even years after apparently complete recovery. Animal (including insect) carriers may transmit infection to human beings either from other persons affected with disease (typhus fever is carried from person to person by lice), or from the lower animals to man (the plague is sometimes carried from infected rats to human beings by the agency of fleas). Animals also act as intermediate hosts, *i. e.*, they lodge the infecting parasite during some necessary cycle of its existence which may be quite different from that seen in man. Thus the ordinary beef tapeworm in its adult form lives in the human intestine and scatters its eggs in the fecal discharges. Cattle become infected by eating grass, hay or other food contaminated by these eggs. The eggs develop into embryos in the gastro-intestinal canal of these animals, and then penetrate into the voluntary muscles in which they become encapsulated (larvæ) as minute oat-like bodies. When infected beef, either raw or insufficiently smoked, is eaten by man the parasites quickly develop again into the adult state and the cycle is complete. If no raw meat were eaten the disease would die out without further precautions. Impure drinking-water and infected foods (including milk) are important in the spread of infections involving the gastro-intestinal tract and in the propagation of animal parasites. This mode of transmission is familiar to all.

It is unlikely that infection is carried to any great extent through the air except in the form of dust or droplets; much that was formerly called air infection is now attributed with certainty to insects or carriers. The soil is of minor importance except as a vehicle for conveying infectious matter to air (dust) or water. In tetanus and hookworm disease, infectious material contained in earth may enter through the skin, in the former case only in the presence of wounds or abrasions, in the latter through the intact skin ("ground itch").

Classification of Infections.—With these preliminary explanations we may proceed to a classification of infectious and parasitic diseases, arranged primarily in accordance with the mode of transmission, and only secondarily in harmony with other criteria. Diseases which are transmissible in several ways are included under what seems to be the most important division, while diseases concerning whose transmission we are entirely ignorant are classified by analogy.

Class I. Characteristics.—The infectious agent enters, as a rule, through an abrasion or wound of the skin or mucous membranes.

(a) Infections due to pyogenic bacteria: Septicemia, pyemia, erysipelas, gonococcus infection.

(b) Animal diseases transmissible to man: (1) *Bacterial*: Tetanus, anthrax, glanders. (2) *Due to fungi*: Actinomycosis. (3) Caused by an *unknown* agent: Rabies.

(c) An infection (primarily human) due to a protozoan parasite: Syphilis.

Class I. General Prophylaxis.—General prophylaxis in this group depends on careful protection and treatment of wounds, abrasions, and susceptible mucous membranes. It demands the application of ordinary aseptic or antiseptic methods to the treatment of every trivial injury. Boric acid, phenol (carbolic acid), potassium permanganate and silver solutions are often used on mucous membranes to prevent infection. Wounds may be treated according to circumstances by simple aseptic

methods or by incision, drainage, cauterization, and antiseptics (bichloride of mercury, etc.). In certain diseases special preventive measures are useful, *e. g.*, the disinfection of hides from infected countries to prevent anthrax, the prophylactic use of antitoxin after Fourth-of-July and war injuries to afford protection against tetanus, the muzzling of dogs to prevent rabies, and the control of prostitution to limit gonorrhea and syphilis. Most of these special measures will be mentioned again under the individual diseases. Accidental transmission of these infections to others is unlikely (except perhaps in erysipelas) if ordinary care is taken to destroy infectious discharges and objects (such as dressings) soiled by them. Towels and linen should be sterilized by boiling or by the use of disinfectant solutions, bichloride of mercury 1 to 1000, phenol 1 to 20, "formalin" (*i. e.*, 40 per cent. formaldehyde solution) 1 to 10 ($40 \times 10 = 4$ per cent. formaldehyde gas), or compound solution of cresol 1 to 100. Partial quarantine or isolation is the rule in erysipelas, gonococcus infection with discharge, tetanus, rabies, syphilis (active), etc.

Class II. Characteristics.—In this group infection is disseminated through the agency of insects which act either as carriers or as intermediate hosts. A goodly portion of these infections is due to protozoa. The causative organisms in the remaining and larger fraction are either bacterial or are uncertain.

Transmission.—*By Mosquitoes.*—Malaria, filariasis, yellow fever, dengue.

By Flies.—Sleeping sickness and other mainly tropical affections. (Typhoid fever, dysentery, the exanthemata, etc., in which flies play an important but secondary role in the transmission of infection, are classified elsewhere.)

By Ticks.—Rocky Mountain fever, Texas fever, etc.

By Fleas.—The plague (bacterial). Rats and squirrels are susceptible and keep the infection alive in the intervals between epidemics. Fleas carry the infection from the rodents to man.

By Lice or Bed-bugs.—Typhus fever, relapsing fever.

Class II. General Prophylaxis.—The general prophylaxis of this group consists in scrupulous cleanliness of person, clothing, and surroundings, destruction of insects and vermin, careful screening, cementing of rat holes, filling up of pools and swamps, and similar measures of sanitation. Disinfection in the ordinary sense is useless, although some disinfectants (sulphur for example) are valuable because they are excellent insecticides. Kerosene is employed to destroy mosquito larvæ in undrained pools; it acts by preventing them from reaching the surface to breathe.

Class III. Characteristics.—In diseases belonging to this group the infectious agent usually enters through the respiratory tract (comprising the tonsils) and is disseminated by discharges from the same region, including sputum, nasal and even aural discharges (the middle ear is in intimate relation with the pharynx by way of the Eustachian tube). Desquamating epithelium is a possible source of contagion in some exanthemata and while not so important as formerly believed, should not be entirely disregarded.

(a) *Due to Bacteria:* Diphtheria, cerebrospinal fever, pneumonia, influenza, whooping-cough, tuberculosis, leprosy.

(b) *Uncertain or Unknown Causation:* Infantile paralysis, follicular tonsillitis (streptococcic), rheumatic fever, glandular fever, mumps, measles, German measles, scarlet fever, smallpox, chicken-pox.

Class III. General Prophylaxis.—The general prophylaxis of this group consists in the avoidance of direct contact (in many cases partial or absolute quarantine), and in the disinfection or destruction of discharges. "Droplet" infection and dust infection are particularly common in diseases of this class. Carriers also play an important role, as in diphtheria, pneumonia, and tonsillitis. Old linen, gauze, or paper napkins, should be used instead of handkerchiefs to receive nasal discharges or sputum. Soiled pieces should be put into paper bags and

the whole burned at suitable intervals. With the same end in view sputum may be received into paper containers, or porcelain (or enamel) cups containing antiseptic fluids may be substituted. The best fluids for the purpose are strong lye, phenol (carbolic acid), 1 to 20, and "formalin." Cups in permanent use should be frequently scalded, or in institutions, sterilized in a special apparatus by live steam. Cotton pledgets employed in cleansing the mouth or dressings used for running ear should be burned. In the eruptive fevers (exanthemata) the skin should be anointed during the convalescent period with petrolatum, plain or medicated, to prevent the diffusion of scales. Other special methods of prophylaxis include vaccination for smallpox and prophylactic injection of antitoxin in diphtheria.

Class IV. Characteristics.—In this group the infectious agent enters by the mouth (the hookworm is ordinarily an exception) and as a rule multiplies in the gastrointestinal tract.

Subdivision a.—The infection is disseminated principally by the intestinal discharges. Bacterial: typhoid fever, paratyphoid fever, colon infection, Malta fever, cholera, bacillary dysentery. Animal microorganisms and parasites: amebic dysentery, roundworms, threadworms, hookworm disease (infection usually enters through the skin).

Subdivision b.—Dissemination occurs through the agency of intermediate hosts. Animal parasites: tapeworms, trichina, *ecchinococcus*, *cysticercus*, etc.

Class IV. General Prophylaxis.—General prophylaxis in this group is principally concerned with the protection of the food and water supply. For the attainment of this end disinfection of discharges (particularly urine and feces), the regulation of sewage disposal, provision of pure water (filtration), and the inspection and control of meat, milk, and other foods are essential. Carriers, both insect and human, play an important part (typhoid). Dust infection is occasionally a source of danger. Direct and indirect contact are of minimum importance.

Urine and feces may be disinfected by adding an equal

quantity of some strong disinfectant, mixing, and allowing to stand for a half-hour or more. Phenol one to twenty, cresol (liquor cresol comp.) 1 to 50, chlorinated lime, 1 to 20 (6 ounces to the gallon), and "formalin" 1 to 10 are used for both urine and feces; for the latter milk of lime is also commonly employed. In some modern hospitals sterilizers have been introduced for the steam disinfection of bed-pans and their contents. Precautions should be most stringent in the case of typhoid, cholera, and dysentery.

Communicable Disease.—For purposes of public health certain infectious diseases are designated as communicable, and thereby come under the supervision of local health officers. The list of reportable diseases varies in different localities and is determined in part by considerations of expediency. The following is an official list set forth by the Public Health Council of the State of New York: Anthrax, chicken-pox, Asiatic cholera, diphtheria (membranous croup), amebic and bacillary dysentery, epidemic cerebrospinal meningitis, epidemic or streptococcus (septic) sore throat, German measles, glanders, measles, mumps, ophthalmia neonatorum, paratyphoid fever, plague, acute anterior poliomyelitis (infantile paralysis), puerperal septicemia, rabies, scarlet fever, smallpox, trachoma, tuberculosis, typhoid fever, typhus fever, whooping-cough.¹

Periods of Incubation.—According to the same code the maximum period of incubation (that is, the time between the date of the exposure to the disease and the latest date at which it is likely to develop) of certain communicable diseases is as follows:

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|----------------|---------|
| Chicken-pox | 21 days |
| Measles | 14 " |
| Mumps | 21 " |
| Scarlet fever | 7 " |
| Smallpox | 20 " |
| Whooping-cough | 14 " |

¹ The Pennsylvania law (28th of May, 1915) includes in addition the following diseases: Actinomycosis, erysipelas, leprosy, malarial fever, relapsing fever, tetanus, trichiasis, yellow fever, impetigo contagiosa, pellagra, scabies, uncinariasis.

To these may be added the following derived from various sources:

| | |
|-------------------------------|----------|
| Cerebrospinal fever | 5 days |
| Diphtheria | 7 " |
| Erysipelas | 10 " |
| German measles | 21 " |
| Rabies | 3 months |
| Tetanus | 4 weeks |
| Typhoid fever | 21 days |
| Typhus fever | 21 " |

After the expiration of these periods infection is extremely unlikely. Cases may develop, however, very much earlier; diphtheria, *e. g.*, frequently within two days.

Periods of Isolation.—The minimum period of isolation for certain diseases is stated as follows (this and much that follows is quoted, with slight verbal changes, from the New York regulations): Chicken-pox, until twelve days after the appearance of the eruption and until the crusts have fallen and the scars are completely healed; diphtheria (membranous croup), until two successive negative cultures have been obtained from the nose and throat at intervals of twenty-four hours; measles, until seven days after the appearance of the rash and until all discharges from the nose, ears, and throat have disappeared and until the cough has ceased; mumps, until two weeks after the appearance of the disease and one week after the disappearance of the swelling; scarlet fever, until thirty days after the development of the disease and until all discharges from the nose, ears, and throat, or from suppurating glands, have ceased; smallpox, until fourteen days after the development of the disease and until the scabs have all separated and the scars completely healed; whooping-cough until eight weeks after the development of the disease and until one week after the last characteristic cough. Some authorities believe that the infection is not transmissible after the whoop begins.

Isolation and Disinfection.—Persons affected with communicable diseases are usually isolated, and when so isolated cannot be removed to any other house or hospital without the permission of a health officer. If the patients are properly isolated adult members of the family or household who do not come in contact with the patient or with the secretions or excretions may continue their usual vocations, provided such vocations do not bring them in close contact with children. Cases of smallpox must be removed to special hospitals and those who have been exposed must be vaccinated.

A physician in attendance on any case suspected by him to be Asiatic cholera, dysentery, paratyphoid fever, or typhoid fever, should give detailed instructions to the nurse or other persons in attendance in regard to the disinfection and disposal of the excreta. (See above, Class IV.) In cases of diphtheria, epidemic cerebrospinal meningitis, epidemic or septic sore throat, measles, poliomyelitis (infantile paralysis), scarlet fever, smallpox, or whooping-cough, he should similarly give detailed instructions in regard to the disinfection and disposal of the discharges, from the nose, mouth, and ears of the patient. (See above, Class III.)

The physician or nurse or other necessary attendant upon a case of diphtheria, measles, or scarlet fever, after attendance upon the case, should take precautions and practise measures of cleansing or disinfection of his person or garments to prevent the conveyance to others of infective material from the patient. No person who is affected with any communicable disease or who resides in a household where he comes in contact with any person affected with bacillary dysentery, diphtheria, epidemic or septic sore throat, measles, scarlet fever, or typhoid fever, should handle food or milk for others in any manner whatsoever.

After recovery or death of a person affected with communicable disease adequate cleansing, renovation and disinfection of the premises, cleansing, disinfection or

even destruction of furniture or belongings, and cleansing and disinfection of the patient and his attendants are required. Convalescent patients, nurses, attendants, and "contacts" before being discharged from supervision should shampoo the hair, take a 1 to 10,000 bichloride bath and don entirely clean clothes. In cases of diphtheria one or more negative cultures from the throat or nose should be obtained. The above and some of the following recommendations follow the practice of the Philadelphia Bureau of Health. Clothing which has been contaminated should be disinfected by steam, by boiling water, or by formaldehyde (gas or solution). If rooms are to be disinfected by formaldehyde, three pints should be used for each thousand cubic feet; all cracks and crevices should be closed with cotton or adhesive plaster. In addition there should be an ordinary thorough cleaning with soap and water and full exposure to fresh air and sunlight. Articles such as mattresses and pillows, not readily cleaned, should be sent away and sterilized by steam.

Hospital Quarantine.—In hospitals very strict quarantine regulations are usually enforced. The following rules (abbreviated) are in force in the Presbyterian Hospital in Philadelphia: Cases of stomatitis, pharyngitis, tonsillitis, laryngitis, nasal discharge, oral disease, vaginal discharge in children, and all skin eruptions must be immediately reported. Cases of smallpox and scarlet fever must be immediately removed from the ward and the ward placed under *absolute quarantine* until the period of incubation has passed, and until disinfection has been completed. Cases of diphtheria and of measles (in the children's ward) must be immediately removed, and the ward placed under *special quarantine* until the period of incubation has passed, and until disinfection has been completed. Cases of German measles, chicken-pox, whooping-cough, and mumps in the children's wards, and cases of measles and whooping-cough in the adults' wards must be immediately removed and the infected area placed under *partial quarantine*. Cases of erysipelas,

epidemic cerebrospinal meningitis, tetanus, phthisis, and trachoma must be removed from the general wards. (In many hospitals typhoid fever and pneumonia, as well as venereal diseases in the active stages, are also removed from the general ward. This is done in part for the purpose of facilitating special treatment.)

The following rules apply in the quarters of the hospital under *absolute quarantine*: No new patients may be admitted to, and no patients discharged from, the quarantined zone. Nurses, orderlies, and attendants on duty in the infected quarter must be isolated from all other portions of the hospital. The resident in charge of the quarantined section must not come in contact with patients in other parts of the hospital and must not enter any non-infected ward. The attending physician or surgeon, or any other person after visiting the infected area may not enter a non-infected ward on the same day except in case of extreme urgency, and then only after taking special precautions. All persons, chiefs, residents, visitors, etc., entering the infected zone must wear cap (mask), and gown, and must disinfect hands and face before leaving. The cap and gown should immediately be disinfected or put into a receptacle provided for them. Visitors must not be admitted to the quarantined department except in cases of serious illness and must comply with the regulations as to wearing cap and gown, etc., as outlined above. No article of any sort may be taken from the quarantined district until it has been disinfected. All food containers brought into the infected ward must be placed, immediately after using, in large closed vessels containing a 5 per cent. solution of "formalin," and immersed for one hour. The vessels of "formalin" in which articles are immersed must be placed at the entrance of the infected area, and from them the food containers and other disinfected articles should be removed by an orderly who has not been exposed to the contagion. The food containers should be scalded in hot water before being used again. Garbage, surgical dressings, refuse, etc., from the infected area should be incinerated.

In the portions of the hospital under *special quarantine* all the rules and regulations specified under *absolute quarantine* apply, except those referring to the isolation of nurses, orderlies, and attendants. Nurses, orderlies, and attendants while on duty in the zone under *special quarantine* must wear cap and gown; before entering non-infected wards and before associating with persons who have not been exposed to the contagion they must disinfect thoroughly and must make a complete change of clothing. In partial quarantine the rules are less strict in this respect, since those in attendance need only disinfect their faces and hands and doff cap and gown before entering the non-infected portion of the hospital. Similar, though perhaps less stringent, rules would apply to isolation and quarantine in a patient's home.

In this connection it is only fair to say that there is a tendency in many quarters to do away with all precautions based on the idea of air infection. In France and even in several parts of this country patients with various forms of infectious disease are treated in common wards, in some instances isolated from each other only by tapes. In other hospitals separate compartments (cubicles) formed by glass partitions are provided. Success has been attained by this method when precautions against direct and indirect contact have been carried out with scrupulous care ("aseptic nursing"). Carelessness on the part of physicians or nurses, *e. g.*, hasty and insufficient disinfection of the hands in passing from case to case, is fatal to the success of the plan. For the present most physicians and health officers, while admitting that many of the precautions in vogue are unnecessary and therefore theoretically bad, are content to await a more adequate trial before putting the newer methods into force.

Immunity.—Thus far we have considered only the causative agents of infection. It is well known to everyone, however, that infection occurs only when the patient is abnormally susceptible or the infection overpowering. The capacity possessed by the body for resisting infection

is spoken of as immunity. Under varying circumstances this may be entirely lacking, it may be partial or relative, or it may be absolute. Immunity may be of a general character, limited to a related group of diseases, or more often strictly specific. Thus a person who is immune to measles or smallpox may be susceptible to German measles or chicken-pox. Certain persons and even whole races appear to have an unusual degree of immunity against certain diseases, or, on the other hand, an undue susceptibility to these or other diseases. In any given case this cannot be assumed without a thorough knowledge of all the circumstances. Thus it was formerly believed that the Cubans had a natural immunity against yellow fever. On more careful investigation it was found that most of them suffered from the disease in a very mild form during infancy and were thenceforth protected by this previous attack. The example of natural immunity most often cited is that of the Jews against tuberculosis; the negroes, on the other hand, are peculiarly susceptible to this infection. A previous attack of many infectious diseases yields a more or less permanent protection against subsequent infection. Dr. Rosenau gives the following list of diseases which afford such protection:

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|----------------------|---------------------------|
| Smallpox. | Typhoid fever. |
| Yellow fever. | Typhus fever. |
| Measles. | Chicken-pox. |
| Whooping-cough. | Mumps. |
| Scarlet fever. | Cerebrospinal meningitis. |
| Infantile paralysis. | |

A previous attack of pneumonia, diphtheria, erysipelas, or malaria seems to predispose to subsequent attacks.

Antitoxins.—The mechanism of immunity is too complicated and too obscure to permit of any simple explanation which would be at all adequate; it must suffice, therefore, to mention a few important points which bear on current methods of diagnosis, prophylaxis, and treatment. In the course of their growth in the body many pathogenic microorganisms throw out virulent

poisons or toxins which evoke the characteristic symptoms of the particular disease. The diphtheria bacillus is the best-known organism of this sort. Other microorganisms, like the tubercle bacillus, give off little or no toxin during growth, but the bacterial bodies contain endotoxins which will occasion symptoms when released by the death and disintegration of the microorganisms. Bacteria of this class multiply, as a rule, in many localities in the body and call forth local reactions: Inflammatory exudates, abscesses, peculiar forms of infiltration, softening, etc. To meet the first sort of infection the cells of the body manufacture a chemical antidote which is specific for the particular infection and is known as an antitoxin. If the patient can produce a sufficient quantity of this antidote to neutralize the toxins before irreparable injury has been inflicted on the vital organs, recovery occurs. If the toxin can be extracted from bacterial cultures and injected into men or animals in repeated doses, at first minute but later massive, an artificial immunity can be produced which is due to the formation of antitoxin. This method has long been used to produce diphtheria and tetanus antitoxin in the horse. When a horse has been sufficiently immunized a larger portion of his blood is withdrawn and the serum separated, purified, and concentrated. A portion of this serum injected into a healthy person will lend him a temporary passive immunity; if injected into a person in the early stages of diphtheria it will supplement the patient's own stock of antitoxin and bring about a rapid recovery in the vast majority of cases. Before antitoxin is marketed it is tested as to its power to neutralize definite quantities (units) of toxin and its strength is then stated in "units;" an ordinary dose of diphtheria antitoxin is three thousand units.

The production of antitoxin is not the only resource of the body in its struggle with invading bacteria. Other substances are also developed in the serum which will cause the offending bacteria to clump together, to lose their motility, to precipitate, and finally to dissolve.

These properties may also be artificially developed in serums for therapeutic purposes. The Widal reaction, so generally used for diagnosis in typhoid fever, is based on the above-mentioned agglutinating property of immune serums. It does not appear, therefore, at the onset of the disease, but only after a certain immunity has begun to develop. (Fig. 65.)

Phagocytosis and Vaccines.—The cellular elements of the tissues also take an active part in this "battle" with the invaders. The presence of infection usually calls out an excess of leukocytes in the blood (leukocytosis), while bacteria in the tissues are speedily surrounded by a host of these same white cells which endeavor to "devour" them (phagocytosis). It is not an uncommon thing to see a half-dozen bacteria inside a single leukocyte. If the outpouring is excessive an abscess may result, but even this apparent defeat and sacrifice of countless leukocytes (pus cells) may lead to recovery by bringing about discharge of the invaders with the pus. In the more chronic infections (*e. g.*, tuberculosis) cells of other types are brought into action and tend to form connective-tissue capsules about the bacilli and thus isolate them from the rest of the body (latent tuberculosis). If the reaction against invading bacteria is insufficient for lack of stimulus, as often happens in subacute and chronic infections, vaccines may be injected subcutaneously in ascending doses to provoke a more active resistance on the part of the defensive (immunizing) agencies. Vaccines are made by suspending in salt solution a pure culture of the offending microorganisms, previously killed by a sufficient application of heat. The vaccine is diluted so that each c.c. contains a definite number of bacteria (one to one hundred million or more). The various tuberculins, although differently prepared, embody the same principle. Vaccines are used not only to assist in the cure of disease, but in the establishment of an active immunity. As is well known the whole personnel of the United States Army is protected by antityphoid vaccination against enteric

fever. In this instance the immunity lasts for two or three years, not for life, as is usual after spontaneous attacks of the disease.

Viruses.—The injection or inoculation of live cultures (viruses) is very commonly practised by veterinarians to develop immunity against certain animal disease and particularly against anthrax. The cultures are weakened or attenuated, as the phrase is, by passing them through resistant animals, by growing them under unfavorable conditions, or by exposing them to heat or drying. In human beings the use of viruses is generally forbidden except in specific instances in which they are of proved value. The virus of rabies, attenuated by drying, is employed to develop an immunity against this disease after infection has occurred, but before the incubation of the disease is completed. This is possible because the incubation period is fortunately very long. The virus of vaccinia (cow-pox) or true vaccine is used to develop an active immunity against smallpox. Vaccinia is merely a mild form of smallpox which has been permanently deprived of its virulence and contagiousness by implantation on a resistant animal—the cow. The vaccines previously mentioned are so-called because of their fancied resemblance to the original vaccine. As we have seen, however, they consist of dead cultures, while the true vaccine is a living virus.

Summary.—*To recapitulate:* Immunity may be natural or acquired. Acquired immunity may be passive, as after the injection of antitoxin, or active, as after an attack of one of the infectious diseases. Immunity may follow a spontaneous attack of disease, the artificial inoculation of an unmodified virus, inoculation of a modified virus, vaccine injections, injections of antitoxic serums, injection of antibacterial serums, etc.

Fever.—Fever is the most striking evidence of the reaction of the body against invading microorganisms. Simple pyrexia (rise in temperature), however, may be due to other causes than infection, such as sunstroke

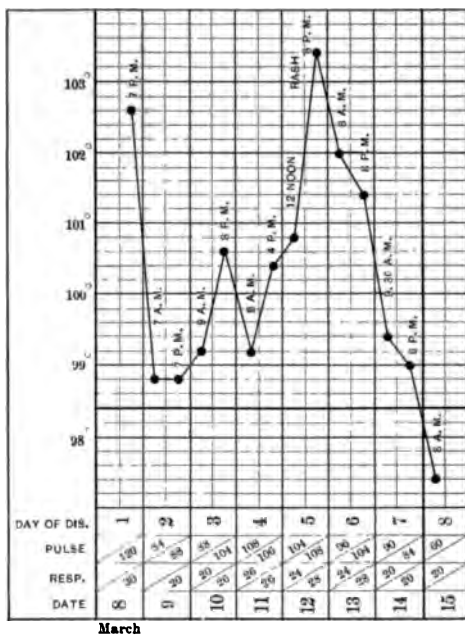
and brain injuries, but is not then associated with the ordinary evidences of toxemia. The febrile state is accompanied by many symptoms, some of the more frequent of which are: shivering, chills, sweats, headache, insomnia, delirium, stupor, anemia, leukocytosis, rapid pulse, alterations in blood-pressure, rapid respiration, loss of appetite, constipation, scanty, high-colored urine, albuminuria, loss of strength, weakness, prostration.

The degree of fever is usually classified in accordance with the following simplified scheme (Rosenau):

| | |
|-------------------------------------|-------------------|
| Subfebrile or high normal | 99° to 100° F. |
| Low febrile | 100° to 101° F. |
| Moderately febrile | 101° to 103° F. |
| High febrile | 103° to 105° F. |
| Hyperpyrexial | 105° F. and over. |

If the temperature reaches 103° in the morning it is significant of a highly febrile state; the same temperature in the evening might not be excessive. The normal daily (morning and evening) variation in temperature is less than one degree; in fevers it is frequently much greater.

Types of Fever.—The onset or invasion of a fever may be sudden and violent, as in pneumonia, or gradual, as in typhoid fever. After a fever has attained its height this high temperature is usually maintained from a few days to two or three weeks; this stage is known as the "fastigium." In some eruptive fevers (*e. g.*, smallpox, measles) the course of the temperature may be temporarily interrupted by a remission. At the end of the fastigium the temperature falls either suddenly by crisis, or gradually in a step-like manner, by lysis. At this stage also there may be a temporary remission of temperature as in the pseudo-crisis of pneumonia. In convalescence from fevers there may be recrudescences, that is, temporary elevations caused by overfeeding, constipation, excitement, etc., or there may be true relapses which repeat all the features



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FIG. 50.—Measles showing remission before appearance of eruption. (Musser.)

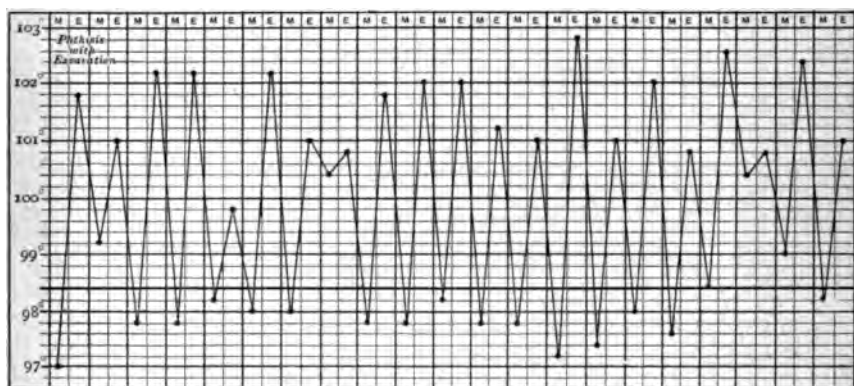


FIG. 51.—Intermittent fever of tuberculosis. (Musser.)

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of the original attack. *Continued fever* is characterized by sustained temperature with only slight diurnal variations. Croupous pneumonia and typhoid fever are characteristic types of continued fever. *Remittent fever* exhibits wider diurnal variation without, however, descending to normal. Typhoid fever is remittent during the stages of invasion and lysis. Estivo-autumnal

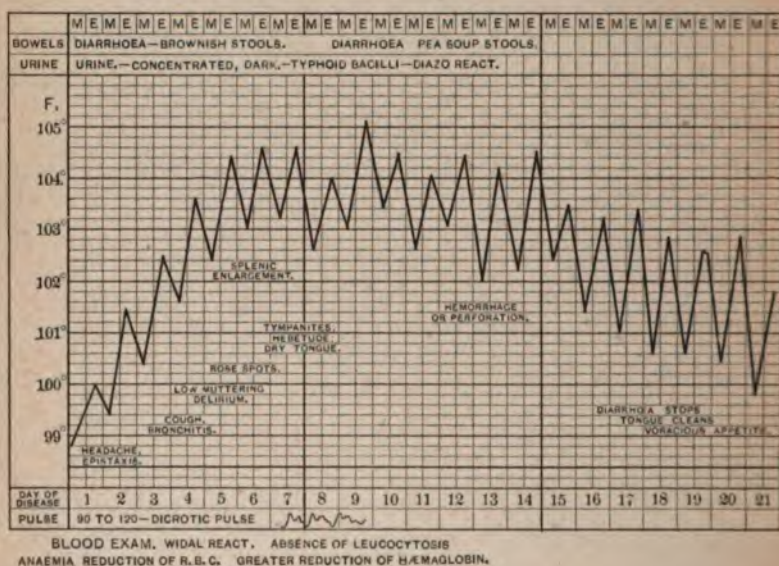


FIG. 52.—Typhoid fever. Course of fever and relation to symptoms. (Musser.)

malaria is a typical remittent fever. In intermittent fever the temperature reaches the normal or even falls below it in the intervals between the febrile paroxysms. The most typical intermittent fever is that seen in malaria, in which there is a regular rise of temperature every day or every other day, with normal records in the interim. The hectic fever of advanced tuberculosis and the fever

of septicemia and pyemia may be either remittent or intermittent. In pyemia the diurnal variations may be

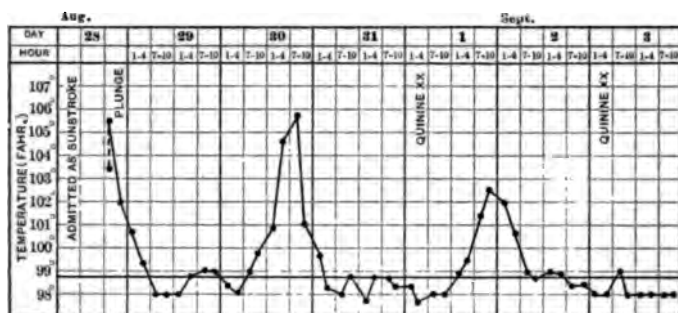


FIG. 53.—Intermittent tertian fever. Malaria without chills.

enormous, the temperature ranging from subnormal to hyperpyrexial within a few hours. (See Fig. 22.) The

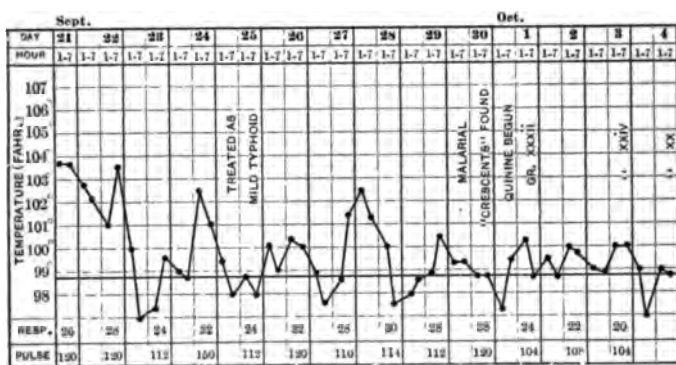


FIG. 54.—Estivo-autumnal fever.

paroxysms are accompanied by severe chills and drenching sweats.

Thermometry.—The temperature should always be determined by the thermometer, for while experienced physicians may, in the majority of instances, estimate the degree of fever very accurately by the hand, in other instances they may be entirely at sea. The best idea of internal temperature is obtained by taking the observation in the rectum. This method is in general use in tuberculosis sanatoria since slight febrile variations are of great importance in early or incipient tuberculosis. It is also commonly used in infant practice. In ordinary cases the mouth and axilla are the most convenient for this purpose and the readings obtained sufficiently accurate. The temperature in the axilla is at least a degree lower than in the rectum. The temperature in the mouth is intermediate between the two. It is hardly worth while to dwell on the technic of thermometry, but a few points may be emphasized. The mouth temperature is likely to be low if the patient has been breathing through the mouth or has taken cool or cold food or drink shortly before. If the temperature is much below normal the observation should be repeated to exclude an error in technic. Shortly before writing this paragraph I noted, while making "rounds" in a ward of twenty-six beds, that eight patients had temperatures of 95° or lower! On investigation it was found that an inexperienced nurse had made the observations. Most thermometers, however marked, give more accurate readings if left in the mouth for at least five minutes. This is of importance in detecting subfebrile rises in incipient tuberculosis.

Treatment of Fevers.—The reduction of temperature may be accomplished by drugs, antipyrin, acetophenetidin (phenacetin), acetanilid, quinin, salicylates, etc., but this method is now largely discountenanced and abandoned except in acute fevers accompanied by headache, pain, and aching, in which most of these drugs serve a double purpose and if used with discretion can hardly do any harm. For prolonged fevers hydrotherapeutic methods are preferable, as they not only reduce fever but stimulate

the nervous system and improve the circulation in the peripheral vessels and the lungs. Cool or cold water is applied in many ways, the best known of which are tub baths, cold packs, sponging, and the application of cold compresses, ice-bags, caps, etc. As these are sufficiently described in nursing manuals it is not necessary to dwell on them here. Cold air also tends to keep the temperature down and has a most beneficial and stimulating effect on many patients suffering with acute respiratory disease, *e. g.*, croupous pneumonia. Bronchitis in children, the weak and the aged is more favorably influenced by warm, moist air, which, however, should be frequently changed (free ventilation). The air in the room may be moistened by boiling water over a gas flame or a spirit lamp. Sunlight is also a valuable aid in the treatment of chronic fevers. It should be avoided in many acute exanthemata in which the eyes are affected. In tuberculosis fresh, cold air, sunlight, rest, and diet are the physician's chief weapons. Rest is the most essential of all factors in treatment, but in acute disease only needs to be enjoined upon the patient in exceptional cases or at certain stages of the disease. In chronic infection it is often the most difficult condition to secure, either because of the disinclination of the patient to adopt it or on account of his inability to leave his work.

The diet of fevers should be largely liquid or semi-liquid and if the disease is prolonged should be more than adequate to supply the nutritive requirements of the patient. These questions are considered in more detail under Metabolism and in the section on Typhoid Fever. In fevers which do not involve the gastro-intestinal tract or impair the function of the kidneys a rapid return to solid food may be instituted at the beginning of convalescence.

CHAPTER II.

INFECTIOUS AND PARASITIC DISEASES— CLASS I.

THE infectious agent enters, as a rule, through an abrasion or wound of the skin or mucous membranes.

| | |
|--|---------------------------------|
| A. INFECTIONS DUE TO PYOGENIC BACTERIA. | Anthrax. |
| Toxemia, Septicemia, and Pyemia. | Glanders. |
| Erysipelas. | Actinomycosis. |
| Gonococcus Infection. | Rabies. |
| Gonorrheal Arthritis. | C. INFECTION (USUALLY VENEREAL) |
| B. ANIMAL DISEASES TRANSMISSIBLE TO MAN. | DUE TO A MINUTE PROTOZOAN |
| Tetanus. | PARASITE. |
| | Syphilis. |

A. INFECTION DUE TO PYOGENIC BACTERIA.

Toxemia, Septicemia, and Pyemia.—Toxemia, septicemia, and pyemia may be considered at the beginning of our study of bacterial infections because they do not represent definite diseases but systemic states that may be occasioned by a large number of infectious agents. In a narrower sense these terms are applied to general infections caused by the pus-producing (pyogenic) organisms, gonococci, etc. Those varieties in which there is a definite or accessible source of infection as in wound infection or puerperal sepsis come under the care of the surgeon or obstetrician, and are discussed in works on surgery and obstetrics. The more occult or hidden forms come under medical care and will form the principal subject of this section. The investigations of recent years have tended to break down the sharp distinctions between these three manifestations of infection, but they still

serve a useful purpose from the point of view of treatment and prognosis.

Toxemia, though it may bear a different significance, is used in the present connection to designate the systemic state brought about by the circulation in the body of the poisons, specific and non-specific, produced by the growth of various bacteria. The bacteria may themselves circulate in the blood or they may be confined to a limited area whence their toxic products may be distributed throughout the body as in tetanus and diphtheria. Sappremia is a term of similar import usually applied to a mild toxemia resulting from the retention and bacterial putrefaction of necrotic material or tissue (*e. g.*, retained membranes after childbirth). In septicemia the bacteria themselves are carried by the blood to all the tissues and elaborate their poisons wherever they may become established. In this condition we are no longer able to cure the patient by removing the original focus of infection. In pyemia there is not only toxemia and bacteremia (bacteria in the blood), but also multiple abscesses which are set up in favorable locations by pus organisms circulating in the blood. The prognosis in these cases is usually very bad, but not so invariably fatal as was formerly believed. The mortality in cases of septicemia and pyemia due to pus organisms (streptococci and staphylococci) is more than 80 per cent.

Symptoms.—The symptoms of toxemia in the specific infections are considered under the respective diseases, pneumonia, typhoid, etc. The general manifestations of toxemia as seen in pyogenic infections are: chilliness, irregular fever, rapid pulse, headache, restlessness, delirium, loss of appetite, etc., the first-named being the most suggestive. In septicemia the chills are more severe, oft repeated, and associated with high remittent or intermittent fever, and correspondingly severe constitutional symptoms. In pyemia similar symptoms occur but are usually even more severe and the febrile paroxysms are frequently followed by drenching sweats. In malig-

nant endocarditis I have seen the temperature range in a few hours from 95° to 105° or 106°, and occasionally two such paroxysms have occurred in a single day (Fig. 22). The patient's mind frequently remains clear but at other times stuporous states supervene. In the severe cases of septicemia rapid emaciation, severe anemia, jaundice, hemorrhages into the skin, local abscesses, and bed-sores develop. In many instances, however, and particularly in the so-called terminal infections (which, according to Osler, carry off the "majority of cases of advanced arteriosclerosis and of Bright's disease"), the symptoms are very indefinite and the diagnosis is made by cultures from the blood during life or at autopsy. The duration of these cases varies from a week or two to many months. The following is an incomplete list of some of the various causes of toxemia, septicemia and pyemia which are seen in medical practice with more or less frequency: Septic endocarditis, purulent pericarditis, empyema, purulent peritonitis and meningitis, abscess or purulent infiltration of the liver (suppurative cholangitis), of the kidney (pyelonephritis and pyonephrosis), of the prostate, and of the bladder, and infections of the bones, joints, teeth, and sinuses.

In most of the above-mentioned conditions if cultures are taken from the veins (usually at the bend of the elbow) the causative organisms may be grown and identified. Several hours before a blood culture is to be taken the nurse should prepare the skin in the region of the elbow (anterior surface) as if for a major operation, by scrubbing with soap and water, alcohol and bichloride solution, and by applying a dry sterile dressing. At the time the culture is taken the physician paints the region of the vein with 5 per cent. tincture of iodine as an additional precaution. At present iodine alone is frequently used. After a constricting bandage has been applied to the upper arm the physician plunges a large hollow needle into the distended vein and withdraws (usually with a syringe) as much blood as he requires. Before he removes the needle

the constricting bandage should be completely relaxed, otherwise hemorrhage into the subcutaneous tissue is liable to occur. Measured quantities of the blood thus withdrawn are placed in tubes and flasks containing culture media. An alcohol lamp should be at hand for flaming the necks of the flasks, etc.

Treatment.—The treatment should aim to remove the original focus of infection when this can be discovered and is accessible. Teeth may need to be withdrawn or extensive surgical operations undertaken. At autopsy deep abscesses are occasionally discovered which, if properly opened, would have prevented pyemia and death. Recently I saw two cases of this sort, one with a sub-mammary abscess, the other with an abscess deep in the thigh. When cultures from the blood are obtained, special serums may be employed or autogenous vaccines may be prepared. The defences of the body may also be stimulated by drugs such as collargol. Aside from these measures medicinal treatment is stimulant, supportive, and tonic.

An abundant diet of high caloric value, including milk and eggs, is usually advisable and fresh air should be "administered in large doses." The open-air treatment, useful in tuberculosis and pneumonia, is equally indicated here, although, of course not equally successful.

On account of the frequently prolonged course, the extreme degrees of weakness and emaciation, and other depressing factors, the most careful nursing is required to secure comparative comfort to the patient, to avoid passive congestion of the organs, to prevent bed-sores, and to maintain a healthy condition of the mucous membranes. Mouth washes, dusting powders, etc., as described under Typhoid Fever will be required. Prophylactic measures will depend entirely upon the character of the infection. Frequently there are no external evidences of infection. Discharges, if present, should be dealt with as described under the individual infections.

Erysipelas.—Erysipelas is a pyogenic infection caused by the *Streptococcus pyogenes*. This microörganism under certain conditions, which we do not fully understand, produces a specific inflammation of the skin accompanied by symptoms of toxemia. The infection is transmitted in most cases by direct contact; it may be carried by physicians or nurses, or bedding, clothing, and perhaps walls and floors may be the indirect vehicles of contagion. Healthy persons are not susceptible, as a rule, but patients with wounds, newborn children, and puerperal women are particularly liable and should not be exposed to even a remote chance of infection. Nurses who have been in attendance on cases of erysipelas should not go directly to cases of the character mentioned above except after unusually thorough disinfection, and with the knowledge and consent of the physician in attendance. The ordinary form which affects the face is probably inoculated through unperceived fissures and abrasions in the nasal mucous membrane. It is especially liable to attack persons suffering from debilitating chronic diseases such as nephritis or the victims of alcoholism. The symptoms of infection develop from three to ten days after exposure.

The disease begins with rigors or a severe chill followed by high fever which persists for several days and then becomes irregular. The temperature usually falls in about a week by crisis or a little later by lysis. The usual symptoms of fever are present—thirst, loss of appetite, coated tongue, scanty urine, headache, backache, general aching, and nocturnal delirium. In alcoholics delirium tremens is frequent. The eruption in typical cases first appears as a red spot near the bridge of the nose, and, assuming the shape of a butterfly, spreads laterally, upward and downward. It invades the scalp, causes enlargement and thickening of the ears and infiltrates the neck. The inflammation of erysipelas is distinguished by a peculiar "fiery red" color (St. Anthony's fire), infiltration of the skin, and a sharply defined border

as the process advances. In some cases the erysipelalous inflammation may "wander" over a large part of the body. In traumatic cases the situation is determined by the site of the wound. In babies it begins in the umbilical stump.

In some severe cases localized abscesses develop. In one instance I saw gangrene of both hands. Other complications that may be mentioned are phlebitis, arthritis, pneumonia, pleurisy, endocarditis, and nephritis. Relapse may occur and second attacks are common. The mortality in babies, in the aged, and in complicated cases is large, but in the vigorous it is small. The average hospital mortality is about 7 per cent. which is possibly less than that of typhoid.

Treatment.—From what has been said the prophylactic treatment is easily deduced. Erysipelas cases in hospitals should be isolated completely from the surgical and obstetrical wards. Nurses and physicians in charge of such cases should not come in contact with patients in the above-mentioned wards. Care should also be taken to protect subjects of chronic disease, although the precautions may be less stringent when open wounds are absent. The patient or patients should be quarantined and the usual precautions against contagious diseases should be carried out. Clothing, bedding, discharges, dishes, and food should be disinfected. The nurse and physician should wear gowns and disinfect hands and wash the face when leaving the ward. The ward should be cleaned and fumigated from time to time or when the patients are discharged. Similar precautions hold for private cases. The principal precaution should be against conveyance of infection by the hands or infected objects.

The diet should be ample, as the patients are often debilitated. Milk with cereal additions, eggs, and broths will be the mainstay during the febrile period.

The medicinal treatment is not, as a rule, specific, though serums and vaccines have been used with more or less success. Tincture of the chloride of iron and quinin

in large doses are old-fashioned remedies still much used. Stimulation is frequently required. Local applications are employed in great variety, from simple cold-water dressings to ichthyol and collodion. A recent favorite has been saturated solution of Epsom salt applied on a thick gauze mask and covered with oiled silk. All applications should extend beyond the zone of inflammation. Hypodermic injections of antiseptic solutions, bichloride, carbolic, etc., in advance of the border of inflammation are sometimes used.

Gonococcus Infection.—The *Micrococcus gonorrhoeae* attacks with great frequency the mucous membranes of the urethra, vagina, etc., in adults and of the conjunctiva in the newborn. The conjunctivæ are also occasionally involved in adults. It is one of the leading causes of blindness. These manifestations as well as those which follow direct extension from genital infections, such as prostatitis, pus tubes, pelvic peritonitis, etc., do not often fall within the province of the internist. On the other hand, the vaginitis of little girls (babies) is a serious problem in the management of babies' and children's wards because it is difficult to control with ordinary precautions. The infection is apparently conveyed by sheets, night-dresses, napkins, wash-cloths, towels, etc., as well as by nurses' hands. Usually it is necessary to isolate every case admitted with the slightest discharge until a bacteriological examination has been made, and in positive cases to continue the isolation until no gonococci are found on microscopic examination. The patients should wear a napkin of some sort to save their own hands from contamination. After handling the child the nurse should disinfect her own hands with the greatest care. It is well to have special nurses for these cases.

Treatment.—The treatment of vaginitis is by irrigation with various silver salts and by the use of vaccines (*v. i.*).

Gonorrheal Arthritis.—The general manifestations of gonorrhea with which we are directly concerned are of two principal forms: 1. A general septicemia in which

fever and other symptoms of a mild or severe degree may develop with or without ulcerative endocarditis. The symptoms and treatment of septicemia and endocarditis have been described elsewhere.

2. Gonorrheal arthritis or "rheumatism." This may be of varying degrees of severity from a simple arthralgia or pain in the affected joints to a severe suppurative inflammation. Occasionally the tendons and periosteum alone are involved. The majority of cases are characterized by pain and swelling, frequently of one joint, as the knee, at other times of many joints. Unlike acute articular rheumatism the swelling tends to remain more or less persistently in the joints primarily affected instead of skipping about from one to another. Unusual joints such as those of the jaw or spine are also attacked. The constitutional symptoms such as fever and sweats are less marked than in rheumatic fever; sweats indeed are usually absent. The local symptoms moreover are obstinate, and do not yield readily to treatment by salicylates.

Careful questioning will usually elicit a history of gonococcus infection, but in women and children the clue may be given by microscopic examination of vaginal or urethral discharges, the patient frequently being entirely ignorant of the existence of infection. To secure a specimen the labia should be separated and a fresh drop of pus as it exudes from the urethra or vagina collected on a sterile swab and spread on a cover-glass or slide. After the specimen has dried it should be sent to the pathologist for examination. Specimens from the cervix will always be obtained by the physician, as the use of a speculum is necessary. Gonorrheal arthritis is said to attack more than 16 per cent. of those who have acquired the usual form of infection. It occurs at all ages and in both sexes, more frequently in men. One author found that more than 7 per cent. of his cases of arthritis were of gonorrheal origin. Valvular heart disease is much less common than in rheumatic fever; the joint involvement is much more serious and frequently leads to permanent disability.

Treatment.—The medicinal treatment of gonorrheal arthritis is unsatisfactory. Salicylates and iodides are frequently employed, but the former are of use only in relieving pain. Some physicians employ intravenous injection of dilute formalin solution. In severe cases splinting is of value in conjunction with moist compresses (saturated magnesium sulphate solution or lead water and laudanum) covered with oiled silk or wax paper. Passive hyperemia (congestion) is also used. A rubber bandage is placed about the limb some distance above the affected joint with sufficient force to obstruct the venous, but not the arterial, flow. The extremity will become bluish red in color, but should not become cold; the artery should be felt in order to see that it is pulsating normally. After the patient becomes accustomed to the compression it may sometimes be kept up for half a day at a time. Active congestion produced by moist compresses as described above, or in the latter stages by baking, is a pleasanter form of treatment and often quite as effective. If stiffness develops in convalescence the nurse will be called upon to use passive movements and massage.

Gonococcus vaccine has been found of use in obstinate arthritis as well as in the vaginitis of children. The vaccine should be thoroughly shaken to emulsify or mix the bacteria and the required amount injected into the subcutaneous tissue by means of a sterile syringe, filled directly from the container. A point should be selected where the connective tissue is loose and the needle should be plunged in vertically to avoid pain. A preliminary sterilization of the skin with alcohol or iodine is of course advisable. Some physicians plunge the needle through a drop of carbolic solution which acts as an analgesic as well as an antiseptic.

Prophylactic treatment is unnecessary, except when a discharge exists. In such cases napkins, linen, and other articles liable to contamination should be carefully sterilized.

B. ANIMAL DISEASES TRANSMISSIBLE TO MAN.

Tetanus.—Tetanus is primarily a disease of the lower animals and particularly of horses, and is due to a bacillus (*Bacillus tetani*) which is abundant about stables and in garden earth. The organisms flourish only when protected from the air and are therefore apt to infect punctured or contused wounds, but rarely or never open incised wounds. Birth injuries in women and umbilical infections in babies are occasional portals of entry. At times the site of inoculation is so slight as to be overlooked altogether. Vaccination wounds have occasionally been infected by this organism, but with very few exceptions this has been due to lack of care in the treatment of the abrasion and not to the virus itself. Vaccine virus is prepared with great care to avoid any contamination, and as an additional safeguard animal injections are made to determine its freedom from the bacilli. Tetanus is very prevalent in tropical countries where conditions are favorable to its growth. In this country it almost always arises from wounds, and until the agitation for a "sane celebration" was a common sequel of Fourth-of-July injuries. The disease is a very fatal one, its severity being gauged by the length of incubation. Those cases which develop within a few days of injury are extremely fatal, while those which develop after several weeks are usually mild. The symptoms are due to a toxin which attacks the nervous tissues; the bacteria themselves do not invade the blood.

Symptoms.—The first symptoms are stiffness of the jaws which may ultimately lead to "lock jaw," hence the popular name of the disease. The muscles of the neck and back become stiff and the abdomen is board-like in its rigidity. The limbs are less rigid than the trunk. In severe cases the slightest irritation, such as a flash of light, a loud noise, or a sudden movement or touch, brings on severe tetanic spasms (tetanus means straining) which are most distressing to the patient. The head is

drawn back and the spine is arched. Sometimes the cramps are so severe as to prevent respiration; in other cases death follows from starvation on account of the impossibility of feeding the patient through the locked jaws. The fatal issue may be due to simple exhaustion or to complications. In favorable cases the rigidity gradually relaxes, the spasms cease, and ultimately complete recovery ensues.

Treatment.—When infection is suspected, antitetanic serum may be given to the patient with reasonable certainty of preventing the onset of the disease. In war injuries it is customary to give 1500 “units” at once or in divided doses (500 “units” weekly). In severely lacerated wounds which cannot be made aseptic amputation is sometimes a life-saving measure. I have several times seen lives sacrificed in an attempt to save a badly crushed finger or hand. Deep punctured wounds, *e. g.*, by nails incrustated with garden or stable soil, should be freely incised. The South Sea islanders are said to have poisoned their arrows by coating them with gum and soil. The patient himself is not a danger to others but should be isolated for his own benefit in a perfectly quiet, dimly lighted room. He should be disturbed as little as possible.

When there is sufficient room between the teeth the patient should be fed in the usual manner with a feeding tube or spoon; at other times gavage may be employed. The tube is passed into the esophagus through the nose, or even through the mouth after several teeth have been removed. Rectal feeding is another possible resource. All these measures are bad inasmuch as they disturb the patient and are only employed to avert starvation and exhaustion. The foods employed should for obvious reasons be as concentrated as possible.

Medicinal treatment consists in the use of sedatives to palliate the symptoms and to permit of the administration of necessary treatment, and of various drugs which have been thought from time to time to be of some special value, *e. g.*, carbolic acid hypodermically. The

use of antitoxin is the most rational mode of treatment, but unfortunately is of little avail if given late, when the nervous tissues have been seriously or irreparably damaged. Recently I have seen good results in severe cases following the use of multiple antitoxin injections into the region of the wound, into the veins, into the nerves principally affected, and into the spinal canal.

Anthrax.—Anthrax is a disease of sheep and cattle (particularly in the Orient) but is occasionally communicated to man. The causative agent is a spore-bearing organism known as the anthrax bacillus which is notable for its large size and its resistance to disinfectants. This organism is frequently used as a crucial test of the efficacy of any given method of sterilization. When animal anthrax has once gained a foothold in a country, it is extremely difficult to eradicate it from pastures and fields. Fortunately strict quarantine has largely barred it from this country. Infection in human beings generally results from handling hides, hair, and wool taken from animals that have died of the disease. At times outbreaks result from eating the flesh of infected animals. If the disease results from accidental inoculation, as is usually the case in this country, it is known as "malignant pustule." Internal anthrax may affect either the lungs or the gastro-intestinal tract. In the former case it is often called woolsorter's disease. A combination of internal and external anthrax may occur.

Symptoms.—The internal variety of anthrax is characterized by severe constitutional symptoms, general pains, bronchitis, or diarrhea, and in the fatal cases by collapse. The duration is very variable and mortality high. In the absence of an external pustule the diagnosis is suggested by the patient's occupation. My experience is limited to two or three cases of the external type. In these a large central blister appears surrounded by a ring of small blisters, the whole fancifully compared to a signet ring. The centre is subsequently converted into a black slough while all the surrounding tissues become hard and

swollen, simulating pig skin. The disease is more fatal when the face is affected than when it attacks the extremities.

Treatment.—Hides, hair, etc., from infected localities should be effectually disinfected. Cases under treatment should be isolated. Any discharges from the wound or from the nose or throat should be received on gauze and burned. If disinfectants are needed these should be used in strong solution and for a prolonged period. Injections of phenol (carbolic acid) solution around the pustules are sometimes useful in limiting the disease.

Glanders.—Glanders is due to the *Bacillus mallei*. Like anthrax it is found, as a rule, in animals; in this case in the horse. It is accidentally inoculated into persons who come in close contact with diseased animals. It may affect either the skin (farcy) or the nose and respiratory tract, and in either case may assume an acute or a chronic form. In the nose, nodules like large pimples form and later discharge pus. The mortality is extremely high. Osler states that it has caused more deaths among laboratory workers from accidental inoculation than any other germ. On account of its rarity a discussion of its symptoms and treatment is hardly necessary. The preventive measures would be similar to those used in anthrax.

Actinomycosis.—This, again, is a disease ("lumpy jaw") primarily of cattle and pigs, and only secondarily of man. It is due to the ray fungus, a vegetable parasite of a higher type than the bacteria. This fungus may gain entrance through wounds or abrasions of the skin or mucous membranes (although by what means is uncertain), or it may be conveyed by food. Various forms of the infection have been described affecting the skin, the digestive tract, the brain, and the lungs respectively. The form last mentioned which is the one we usually see in man, resembles chronic bronchitis and pulmonary tuberculosis. Fever, wasting, cough, consolidation, and cavity formation in the lung occur just as in the latter

disease. The diagnosis is made by the discovery of the ray fungus and the absence of the tubercle bacillus. The prophylaxis is uncertain on account of our ignorance of the mode of transmission. Disinfection of the sputum or of other discharges is in order.

Rabies.—This disease, also known as hydrophobia and lyssa, occurs primarily in dogs and is communicated by them to human beings. In England, a few years ago, the disease was practically stamped out by rigidly muzzling all dogs for a period of ten months. Since that time muzzling has been relaxed except in certain districts where sporadic cases have occurred. A strict quarantine has also been maintained against all imported dogs. The disease persists in this country owing to varying and poorly enforced regulations. Other domestic animals are susceptible, including cats, cows, and sheep. In Russia wolves also transmit the disease. The virus is contained in the nervous system and in the saliva, and is transmitted by the bite of rabid animals. Free local bleeding and deep cauterization with nitric acid are thought to be preventives if promptly employed. If this method is to be effectual anesthesia should be given.

The causative organism has not yet been definitely isolated, but substantial progress has recently been made in that direction. It is probably a microscopic animal parasite. The incubation is long, varying from two or three weeks to as many months or even longer. A very prolonged incubation is suggestive of hysteria; no disease is mimicked oftener than rabies. For this condition of affairs exaggerated dread, morbid curiosity, and newspaper notoriety are responsible. It is a serious mistake, however, to deny the existence of the disease altogether which some persons, even physicians, have been foolish enough to do. At the present time experimental evidence and a distinct pathology make scepticism appear baseless.

Three stages of the disease are described in human beings: A preliminary stage of mental depression and dread, with irritability of the special senses; a stage of

excitement, occasionally amounting to mania, in which this irritability becomes excessive and spasms of the throat and other parts develop; a final stage in which paralysis and unconsciousness announce the fatal outcome. The hydrophobia (dread of water) is said to be due to spasm of the throat caused by swallowing. Its prominence as a symptom has probably been exaggerated by popular opinion. The duration of the disease is from a few days to a week or more. The mortality is very high.

Treatment.—The preventive measures as before mentioned are largely governmental. Of course the saliva and secretions of the nose should be destroyed and attendants should see that any abrasions on their hands are protected by collodion, although I have never heard of infection taking place in this manner. It is a vulgar superstition to suppose that if the dog is killed before he develops the acute symptoms, the person attacked will be protected. It is far better to have the animal confined and after a proper time killed and examined. In this way a vast amount of needless worry may be avoided.

The patient is isolated, but more for his own protection against irritating lights, noises, etc., than for reasons of prophylaxis. Persons who have been bitten by rabid dogs should receive the Pasteur preventive inoculations as early as possible. In the treatment of the active disease the free use of sedatives and anesthetics is justifiable. If necessary food may be administered by the nasal tube.

C. INFECTION DUE TO A MINUTE PROTOZOAN PARASITE.

Syphilis.—This infection, though primarily a venereal disease, is of great importance in internal medicine on account of its far-reaching consequences. Even the primary lesion is occasionally "accidentally," and frequently innocently, acquired; in the latter case from infected husbands, wives, or parents (congenital form), as the case may be. It deserves, therefore, to be considered

from a purely medical point of view without any necessary reference to morals. The causative agent is a spiral microorganism, the *Treponema pallidum* (*Spirocheta pallida*), which is generally considered to be of animal rather than of vegetable nature. The disease may be congenital, or acquired after birth, and develops in three stages—primary, secondary, and tertiary. In addition there are several diseases and conditions which may develop as the result of the infection, but which have never been

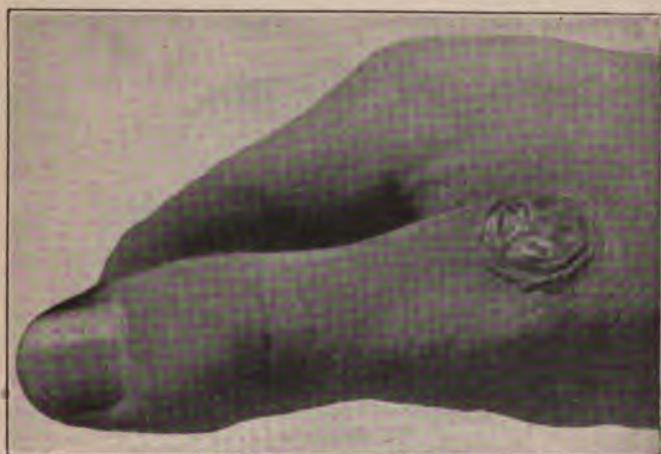


FIG. 55.—Chancre. (Knowles.)

considered as strictly a part of the disease. Recently, however, the treponema has been found even in "paresis," which is one of these so-called parasyphilitic diseases (tabes and paresis).

The primary stage usually manifests itself about three weeks after infection by an indurated papule (chancre) on one of the mucous membranes or occasionally on the skin. In the congenital form infection occurs before birth and the secondary symptoms are present at birth or soon after.

The secondary stage usually develops from three to six weeks later and is manifested by fever, indisposition, general enlargement of the lymphatic glands, sore throat, skin eruptions, mucous patches in the mouth and elsewhere, and falling of the hair. If the eruption is slight and no general examination is made the case may be dismissed as one of simple sore throat. The mucous patches are covered with a grayish-white exudate. They frequently occur at the junction of the skin and mucous membrane and may transmit infection, as in kissing.



FIG. 56.—*Treponema pallidum* stained by India ink (Burri method). (Park.)

The tertiary stage follows after several months and may last, with latent periods, for years. It is characterized by the appearance of widespread manifestations: Skin eruptions in great variety, degenerative diseases of the blood-vessels in the brain and elsewhere, destructive bone disease, tumor-like formations (gummata) in many tissues and organs of the body, etc. According to the parts

principally affected the disease comes under the care of the dermatologist, surgeon, or physician as the case may be. A brief enumeration of some of the principal conditions which may be due to this infection follows: Enlargement of the lymphatic glands, secondary anemia, general arteriosclerosis, atheroma and aneurysm, chronic valvular heart disease, myocarditis, ulceration of the nose and larynx, syphilis of the lung, gumma of the tongue, tonsils, and palate, stricture of the esophagus and rectum, gumma of the liver, syphilitic cirrhosis of the liver, venereal warts and other genito-urinary conditions, cerebral syphilis (tumor), paresis, spinal syphilis, locomotor ataxia, falling of the hair, skin eruptions, ulcers (especially in upper half of leg), syphilitic rheumatism, periosteitis, induration and destruction of the bones (*e. g.*, those of the nose, forehead, sternum and shins).

As a rule syphilitic processes are accompanied by no pain, or by very much less than would be anticipated from the extent of the damage inflicted. The pains when present are often worse at night. Skin eruptions are usually free from itching which often distinguishes them from diseases similar in appearance. In women habitual abortion or miscarriage is suggestive of syphilis. In the last few years the diagnosis of early and of late or obscure cases has been greatly facilitated by the Wassermann reaction. This is a complicated test for which five or more cubic centimeters of blood are desirable. This may be obtained by aseptic puncture of a vein as in making blood cultures or by a puncture of the finger or ear, as in making a blood count (a deep stab is necessary). The blood is collected in clean, narrow test tubes and allowed to stand until the serum has separated. The pathologist uses the clear serum for the test. A positive report indicates that the patient has had syphilis, not always, however, that his present disease is due to that cause.

The disease varies greatly in virulence, due to the resistance of the individual, the results of treatment, or

other causes. In many persons the primary and secondary manifestations may be so slight as to escape observation, and yet severe tertiary or parasyphilitic affections may develop, and *vice versa*. In the congenital form persistent rhinitis, skin eruptions, and fissures about the mouth and anus are the commonest manifestations. In later youth and early adult life, interstitial keratitis, deafness, destruction of the nasal bones (saddle-nose), bone disease, and nervous affections are perhaps the most common results.

Treatment.—The treponema has been found in practically all the lesions of syphilis, so that care should be used in collecting and destroying nasal and other discharges or secretions from moist lesions. Dishes and other utensils liable to contamination should be kept separate or disinfected by boiling or by bichloride of mercury solution. In hospitals separate wards should be provided for active cases with external manifestations. Municipal or State control of prostitution has not met with success, except perhaps in the army and navy, largely on account of the inherent social and moral difficulties of the situation. In one State a law was recently passed requiring medical examination before marriage, but it was declared unconstitutional by the courts. The most practical methods aside from moral instruction are: Education in regard to the dangers of the disease, the provision of adequate hospital facilities for the treatment, so far as possible, of all active cases, and compulsory notification to secure proper supervision of the patients. Information thus obtained should of course be regarded as confidential in order to avoid unpleasant notoriety for the unfortunate victim. Even ordinary active treatment may be regarded in a real sense as prophylactic, since it prevents the development of contagious lesions and in pregnant women often insures the birth of a living child.

Until recently the accepted treatment was by mercurial preparations—mercury ointment (inunction), gray powder (infants), calomel (inhalation), bichloride of mercury,

yellow iodide and red iodide (by mouth), salicylate of mercury (hypodermically)—in appropriate doses, succeeded or combined with potassium iodide. The mercury was usually given in as large doses as the patient could tolerate without poisonous manifestations (salivation and diarrhea). The iodide was also given in ascending doses. For early cases a course of about two years was usually recommended. If the treatment was taken up at a different stage it was variously modified. A few years ago Ehrlich's salvarsan (similar or identical compounds are: arsenophenol-amine and arsenobenzol), and later his neosalvarsan were introduced. These are powerful arsenical preparations which are administered in sterile solution intravenously. All the apparatus used must be sterile and the arm should be prepared as for a blood culture. In the case of neosalvarsan cold sterile water is used for preparing the solution. The special funnel is first filled with water or with salt solution to expel air from the apparatus, the needle is introduced, and after a free flow is assured the water is replaced by the freshly prepared medicinal solution. The fluid is run in slowly and is followed by a little water to secure a full dose and to prevent irritation of the tissues by the arsenic. On account of the variations in technic and apparatus a fuller description is unnecessary. It was at first hoped that salvarsan would effect a complete cure after one or two injections, but although the results obtained have in many cases been remarkable they have fallen short of this ideal. It has been found that a series of doses is preferable and most physicians combine this treatment with an old-fashioned "course" of mercury and iodides.

CHAPTER III.

INFECTIOUS AND PARASITIC DISEASES— CLASS II.

INFECTIONS disseminated through the agency of insects which act either as carriers or as intermediate hosts.

BY MOSQUITOES.

Malaria.
Filariasis.
Yellow Fever.
Dengue.

BY FLIES.

Sleeping Sickness.

BY TICKS.

Texas Fever.
Rocky Mountain Fever.

BY FLEAS.

The Plague.

BY LICE OR BED-BUGS.

Typhus Fever.
Relapsing Fever.

INFECTION SPREAD BY MOSQUITOES.

Malaria.—Malaria has always been, and still is, one of the most common and fatal diseases of the tropics; in temperate zones it is far less serious and in recent years, owing to improved sanitation, has decreased enormously in frequency. In the past many conditions were falsely labeled malaria, but the discovery of the parasite in the blood has enabled physicians to diagnose the cases with more accuracy. In malarial districts, typhoid fever, tuberculosis, gall-stone disease, and subacute infections generally are mistaken at certain stages for malaria; headaches and neuralgias are also frequently attributed without sufficient reason to the same cause.

Varieties, Etiology and Prophylaxis.—Malaria is due to a minute protozoan parasite known as the plasmodium which is found particularly in the blood and spleen. There are three "specific" varieties of this parasite, each of which has a special cycle of development in the red cells of the blood. The "tertian" organism (*Plasmodium vivax*) completes its cycle within forty-eight

hours. At the end of this period the parasite which now completely fills the red blood cells segments into eighteen or more spore-like bodies. The latter penetrate fresh red cells and the cycle begins anew. The malarial paroxysm (chill, fever, and sweat) coincides with the ripening and segmentation of the parasites. If the patient has a double infection one group of parasites matures each twenty-four hours ("quotidian"); if there is a single infection paroxysms occur on alternate days (Fig. 53). This is the common form of malaria in this climate. The "quar-
tan" parasite (*Plasmodium malarie*) reaches full develop-

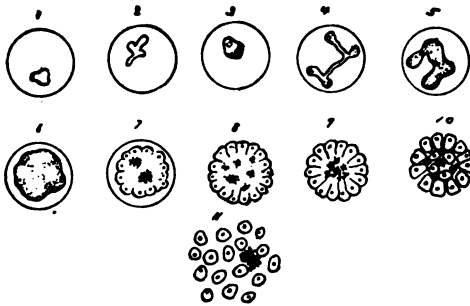


FIG. 57.—Some of the principal forms assumed by the plasmodium of tertian fever in the course of its cycle of development. (After Thayer and Hewetson.)

ment in seventy-two hours, producing a chill every third day. If there are multiple infections there may be chills on two days with a free interval of one day, or with three infections, chills every day. This form of malaria is rare in this country but common in the tropics. The third variety of parasite is the "estivo-autumnal," so-called from the prevalence of the disease in the late summer and autumn. Like the tertian parasite this organism causes a paroxysm on alternate days, or in case of double infection, every day, but the fever soon loses its intermittent character and tends to become remittent instead

of intermittent, that is, the temperature does not return to normal in the intervals between the febrile attacks (Fig. 54). After a few days peculiar bodies, known as "crescents" (hence *Plasmodium falciparum*), are found in the blood. This type of malaria is very prevalent in tropical and subtropical climates and is not infrequently brought to our sea ports from the "Spanish Main." After the Spanish-American War the disease was fairly common in Philadelphia. This variety is sometimes known by the appellation "remittent fever," and by various local names, such as "Chagres fever" at Panama, and "Roman fever" on the Roman Campagna.

The malarial parasite finds its natural habitat in the body (digestive tract) of a particular species of mosquito, known as the "anopheles." It there undergoes a cycle of development entirely distinct from that which occurs in the human blood cells, and ultimately reaches the salivary glands of the insect. Man is an intermediate host and receives the spores from the bite of this insect. Mosquitoes in turn are infected or reinfected by biting malarial subjects. The conditions for the spread of malaria are therefore the presence of a special variety of mosquito and of infected human beings to keep the disease alive. If there were no human "carriers," the disease would soon die out on account of the short life of the mosquito, and if there were no mosquitoes, the same result would ensue, because there would be no means of transferring the disease from person to person. Preventive treatment accordingly concerns itself with two principal objects. First, the cure of infected persons, and second, the destruction of mosquitoes and of their breeding places. In Italy the government supplies quinin in malarial districts in the hope of curing the chronic cases which carry the disease over from year to year. In other infected localities (Panama) hospitals and houses are screened with fine mesh wire. Pools, cisterns, and receptacles, even tin cans, which might serve as breeding places for the mosquitoes are screened, filled up, or other-

wise rendered harmless. Pools, swamps, and sluggish streams which cannot be filled up or drained are treated with petroleum and other insecticides.

Symptoms and Treatment.—Ordinary tertian malaria is characterized by a regular succession of severe chills and rigors followed by high fever and profuse sweats. Even during the chill the rectal temperature will be found to be high. The patient appears to be extremely ill, but after the lapse of four or five hours the temperature falls and a state of complete or comparative comfort is restored, which persists until the onset of the following paroxysm twenty-four or forty-eight hours later. In untreated cases the chills tend to become less regular and to occur a few hours earlier than would be expected. During the paroxysms the patients frequently suffer from headache, backache, and general pains. Occasionally there is delirium or even stupor and coma. Loss of appetite, coated tongue, and disturbances of the bowels (diarrhea or constipation) are symptoms of common occurrence in this disease. After a succession of severe chills there develop decided weakness, pallor, yellow or sallow hue, enlarged spleen, and albuminuria. Fever blisters on the lips and nose are very characteristic of this affection. In this form of malaria quinin is an absolute specific acting in an almost miraculous manner. Usually 15 to 30 grains are given in divided doses shortly before an expected chill. This does not entirely prevent the chill, but destroys the minute parasites, which are at that time set free into the blood stream by the bursting of the ripe segmenting parasites. (There are other less plausible explanations.) If there is a double infection a similar dose is required the following day. After that quinin is continued in decreasing doses and finally stopped. It is usual, however, to administer a large dose at intervals of a week or less until the possibility of recurrence has disappeared.

The estivo-autumnal type, which is also occasionally seen in our hospitals runs a course in the early stages very

like that of typhoid fever, although the temperature is somewhat more irregular and remittent. The patient is prostrated and may present most, if not all, of the so-called typhoid symptoms, such as stupor, low delirium, brown tongue. These cases also respond readily to quinin but not so rapidly as the ordinary "intermittent." Arsenic is frequently used as an adjuvant to quinin during convalescence.

Malignant types of malaria, popularly known as congestive chills, are marked by profound prostration, unconsciousness, and sometimes a fatal termination. In hot weather I have seen severe attacks of ordinary malaria with unconsciousness mistaken for sunstroke. Another grave malarial condition is the so-called black-water fever, seen in South Africa and elsewhere, in which the patients pass urine deeply stained with blood pigment.

Filariasis.—Filaria are small thread-like worms which infect man through the agency of mosquitoes. The embryos live in the lymphatic vessels and at night wander into the blood. They may be found in smears taken at this time, but not during the day. The ordinary species, *Filaria sanguinis hominis*, is found in the tropics and causes swelling of the scrotum or leg (elephantiasis) and chyluria (milk-like urine). These effects are due to obstruction of the lymphatics. Imported cases are occasionally seen in our hospitals.

Yellow Fever.—Yellow fever is an acute infectious disease of warm climates, which occasionally invades northern latitudes. In the eighteenth and early nineteenth centuries severe epidemics occurred in Philadelphia and other Northern cities, and prior to the Spanish-American War local epidemics were not at all uncommon in the South. The disease in the latter case was imported from Cuba and Central and South American countries where it was formerly endemic (constantly present). Since the war, increased knowledge of the disease and improvements in sanitation have caused it to disappear in this country. The organism which causes yellow fever

is in dispute, but it is certain that it is disseminated by a special variety of mosquito. This discovery has led to a complete change in methods of prophylaxis, and for this reason the disease deserves some consideration in this place. Formerly when yellow-fever patients were brought to our ports elaborate disinfection of the ships and of all fomites, including infected clothing and linen, was insisted upon. The patients were isolated with precautions as elaborate as in the case of smallpox. At the present time infected patients are isolated in screened rooms and the mosquitoes, in the hold of the ship and elsewhere, are destroyed by fumigation. Exposed persons are detained or kept under observation during the period of incubation (five or six days) but all precautions as regards infected clothing, etc., are disregarded as useless. It is unnecessary to consider the symptoms of the disease in detail. It is characterized by a febrile course with a stage of remission, jaundice, vomiting, and frequently by renal complications. Sometimes there is vomiting of blood, so-called "black vomit." In Cuba and other subtropical countries, the disease is usually acquired in infancy which accounts for the immunity of the native races. In adults, particularly in foreigners, the mortality is very high.

Dengue.—Dengue, or break-bone fever, may be mentioned in this connection. It is also transferred by mosquitoes and occurs in epidemic form in warm climates. Its popular name is due to the intense headache, backache, and general pains which are present during the fever which is short in duration, and like yellow fever, has a period of remission. The mortality is comparatively slight. In this country it is practically limited to the Southern States.

INFECTION SPREAD BY FLIES.

Sleeping Sickness.—Sleeping sickness is a disease indigenous to equatorial Africa and is mentioned merely

as a type of disease transmitted by flies. In this case the parasite known as the "trypanosome," which causes the disease, is inoculated by the tsetse fly. This scourge has for years decimated large parts of Central Africa, but recently there has been discovered a special drug containing arsenic which is very effectual in curbing the disease. This affection is characterized by a prolonged course (months and even years), general mental hebetude or sleepiness, and a fatal termination.

INFECTION SPREAD BY TICKS.

Rocky Mountain Fever.—Several diseases of minor importance are transmitted by ticks, for example Texas fever and Rocky Mountain fever. According to Osler 700 to 800 cases of the latter disease, with 75 to 80 deaths, occur annually in the mountainous regions of Montana, Idaho, Nevada and Wyoming. The symptoms of the disease, including the hemorrhagic rash are not unlike those of typhus fever. Prophylaxis consists in "dipping or scouring" tick infested horses and cattle.

INFECTION SPREAD BY FLEAS.

The Plague.—The plague is a very fatal infectious disease, indigenous to the East, which occasionally spreads to the temperate zone. In recent years there have been local outbreaks in California, Louisiana, Cuba, and South America, but owing to vigorous action by the health authorities the pest has been kept within bounds. The famous epidemic of this disease known as the "Black Death" which raged in the fourteenth century swept away a fourth part of the population of Europe. Within the last few years the disease has caused the death of tens of thousands of people in India, the Philippines, and elsewhere in the Orient. It occurs in two forms—the ordinary or bubonic plague, characterized by general enlargement of the lymphatic glands with abscess for-

mation (buboes), and the pneumonic form. Both are extremely fatal, the mortality being higher than that of any other infectious disease (90 to 100 per cent.). The causal organism is known as the "Bacillus pestis." The disease appears to be actively contagious in the pneumonic form, but is usually conveyed through the agency of fleas. These not only carry the disease from one person to another but also from rats and other rodents to human beings. The incubation is from two to ten days.

The prophylaxis of the disease is largely concerned with the destruction of infected animals, principally rats and squirrels, and of the insect carriers. The disease is therefore controlled in part by general sanitary improvements, and in particular by a campaign directed against vermin. The difficulty in exterminating rats is greater than anyone not conversant with conditions in ships, wharves, granaries, and public storehouses would suppose. The symptoms and course of the disease need not be discussed since it is unlikely that cases will come under observation.

INFECTION SPREAD BY LICE OR BED-BUGS.

Typhus Fever.—Typhus fever, also known as ship fever and jail fever, is a disease of uncertain cause transferred by lice. At one time it was almost as prevalent as typhoid fever, and until the end of the first third of the nineteenth century the two diseases were usually considered identical. Dr. Gerhard, of the Philadelphia General Hospital, deserves the credit for having finally distinguished them. Since then enteric fever has been described as typhus abdominalis or typhoid fever in contradistinction to typhus exanthematicus or eruptive typhus. "Typhoid" means typhus-like. Typhus fever runs a course of about two weeks and is characterized by a high, continued fever which begins abruptly and ends by crisis. In both respects it differs from typhoid which begins and ends gradually, *i. e.*, by lysis. In

typhus there is an eruption which does not disappear (like that of typhoid) on pressure because it is hemorrhagic in character. The points of resemblance in the two diseases are mainly the stupor, low, muttering delirium, brown tongue, and other so-called "typhoid" symptoms (really symptoms of toxemia). The disease is readily transmissible, probably not so much by direct contagion as through the agency of the formerly ubiquitous body louse. With improvement in sanitation the disease apparently disappeared in this country and was thought to be extinct. In the last few years a mild, infectious disease described as "Brill's disease" has been repeatedly observed in New York, Philadelphia, and elsewhere. This has recently been shown to be nothing more nor less than a mild form of typhus fever. A form of typhus also persists in Mexico. Recently the disease has reappeared in epidemic form in the war-ridden countries of Europe, particularly in Russia, Austria and Servia. In Servia the epidemic was checked largely through the heroic efforts of American physicians and nurses. Prophylaxis in this disease is strictly in the line of improved sanitation—cleanliness, destruction of vermin, and prevention of overcrowding in tenements, lodging-houses, jails, etc.

Relapsing Fever.—Relapsing fever is very rare in this climate, but may be mentioned as an example of a disease transmitted by vermin, in this instance by lice or bed-bugs. There are several varieties of the disease, the best known of which is caused by an organism known as the spirillum of Obermeier which is found in the blood during the paroxysms. The name of the disease is derived from the fact that severe febrile attacks, each lasting for four or five days, alternate with equal periods of well-being without fever.

CHAPTER IV.

INFECTIOUS AND PARASITIC DISEASES— CLASS III.

THE infectious agent usually enters through the respiratory tract (including tonsils) and is disseminated by discharges from the same region, including sputum, nasal, and even aural discharges. Desquamating epithelium is a possible source of contagion in some exanthemata.

A. BACTERIAL DISEASES.

| | |
|---------------------------------|----------------------------|
| DIPHTHERIA. | PNEUMONIA. |
| LARYNGEAL AND NASAL DIPHTHERIA. | Course of Disease. |
| Treatment. | Complications. |
| CEREBROSPINAL FEVER. | Treatment. |
| Treatment. | INFLUENZA. |
| | WHOOPING-COUGH. |
| | Prophylaxis and Treatment. |

Diphtheria. — The term diphtheria is derived from a Greek word meaning a membrane and is applied to a disease which is characterized clinically by membranous deposits on the mucous membranes. These deposits are commonly seen in the pharynx, larynx, and nose, rarely on the conjunctiva and on wound surfaces. The causative organism (the Klebs-Löffler bacillus) is limited to the membrane and produces a virulent toxin, which is largely responsible for the symptoms of the disease. In the larynx the membrane in itself becomes of importance because it may cause fatal obstruction to respiration. Before the discovery of the bacillus, diphtheria of the larynx was commonly known as membranous or pseudo-membranous croup, but these terms are happily becoming obsolete. Diphtheria attacks children by preference, but adults are by no means exempt. Doctors and nurses are

notoriously liable to infection. This emphasizes the fact that the disease is contagious principally for those who come in close contact with the patients and are exposed to what is known as "droplet" infection. Infection may also occur through the medium of "carriers" or of objects soiled with secretions. "Carriers" are immune persons who have been exposed to the disease and carry virulent bacilli in their throats, or convalescents whose throats have not been freed from the infection. There is probably no basis for the idea that the infection is conveyed through the air in any other manner than I have mentioned.

The incubation in diphtheria is brief—one to five days—and the onset insidious. The fever is irregular and only moderately elevated (lower than in follicular tonsillitis), and the general symptoms, such as headache and backache, not severe, but the pulse is weak and often irregular. As the disease progresses prostration becomes marked, but delirium is not a prominent feature. Deposits are seen on the throat early in the disease, at first perhaps on the tonsils, but later spreading to the pillars, palatal arches, and pharynx. Occasionally the membrane is confined to the tonsils. In all doubtful cases cultures are imperative. After four or five days the membrane which has been extending over the tonsils and pharynx begins to loosen and disintegrate, and in a week or two convalescence is well advanced. During the febrile stage albuminuria is pronounced and in convalescence there is a weak and irregular pulse. Danger of sudden heart failure is to be dreaded for a week or two after the patient has apparently recovered. In other and more fatal cases the toxemia is intense and delirium and prostration extreme; in some the disease extends to the larynx or to both nose and larynx; in still others heart failure, respiratory paralysis, bronchopneumonia, or kidney insufficiency causes a fatal outcome.

Laryngeal and Nasal Diphtheria.—In the laryngeal form the constitutional symptoms may be slight, but

the obstructive symptoms, although they may show remissions, do not disappear, but tend to increase until serious or fatal interference with respiration occurs, or until the loosening and coughing up of the membranes bring relief. The chief symptoms of obstruction are inspiratory dyspnea, with retraction of the interspaces between the ribs, stertor or noisy breathing, and cyanosis. The nasal form, while occasionally very severe, is more commonly mild and its character might not be suspected except for the presence of the disease in the throat. Cases of this kind are likely if unrecognized to act as dangerous carriers. Diphtheria of the conjunctiva, while rare, is such a serious danger to eyesight that great care should be taken to avoid it, or if it occurs to administer prompt treatment.

In convalescence the selective action of the diphtheria toxin on the heart muscle, the kidney, and the nervous structures leads to characteristic and often serious sequelæ. The nerves which supply the extrinsic muscles of the eye, the muscles of the palate and pharynx, the muscles of respiration, and the muscles of the extremities are all frequently involved.

Treatment.—The prophylactic treatment of diphtheria is an interesting one. Non-immune persons, particularly children in hospitals or homes who have been exposed, should receive prophylactic injections of anti-toxin, from 500 to 5000 units, dependent on age and other circumstances. This treatment has been extremely successful in checking the spread of the malady and in reducing the mortality in these classes of persons. Unfortunately the immunity afforded is a passive or borrowed one and does not persist for any length of time so that recurring epidemics may require subsequent injections. These might be unobjectionable except for the very rare occurrence of anaphylactic shock and the more common serum sickness which is manifested by hives and other eruptions. Recently an endeavor has been made to produce a combined active and passive

immunity by using both toxins and antitoxins. Some of the objections to prophylactic injections have been met by the introduction of the Schick test¹ which enables us to distinguish immune from non-immune persons. The latter alone require protection. In diphtheria a strict quarantine should be maintained until two or more successive cultures have been returned negative. Sputum, nasal and aural discharges should be collected and destroyed; all utensils should be boiled or otherwise sterilized; food should be burned; clothing and particularly handkerchiefs and linens should be disinfected by fumigation, by antiseptic solutions, or by boiling. The nurse and physician should protect themselves from infection by avoiding close proximity to the patient when the latter is coughing. When applications are being made exposure is unavoidable, but some protection may be given by a gauze mask. A spray for the nose and throat—1 to 10,000 bichloride of mercury—is possibly of some prophylactic value against infection.

The treatment of diphtheria consists in the administration of adequate doses of antitoxin at the earliest possible moment and its repetition when necessary. Massive doses sometimes save life even in apparently desperate cases. The dosage ranges from 5000 units upward according to the age of the patient and the severity of the case. The old drug treatment with calomel or bichloride of mercury is sometimes used in doubtful cases or in emergencies. Local treatment is not usually necessary; the best application is Löffler's mentholated alcoholic solution which contains toluol and chloride of iron. After preliminary drying of the mucous membrane this solution is applied by the aid of cotton swabs.

In laryngeal diphtheria steam inhalations (croup

¹ A minute amount of diphtheria toxin is injected into, not under, the skin, by means of a fine hypodermic needle. In from twenty-four to forty-eight hours a red areola appears in persons who have no natural resistance.

kettle and croup tent), medicated or plain, are of value. If obstruction is progressively increasing, as indicated by respiratory distress and cyanosis, intubation or tracheotomy becomes necessary. In this country the former operation is always the method of choice, as it is safe, bloodless, and in the majority of cases effectual. The operation of intubation consists in the introduction of a special hollow tube (O'Dwyer's), of a size suitable to the age of the patient, into the larynx by means of a curved instrument called an intubator. This tube, which is usually made of hard rubber or gold-plated metal, maintains a passageway of sufficient size to permit

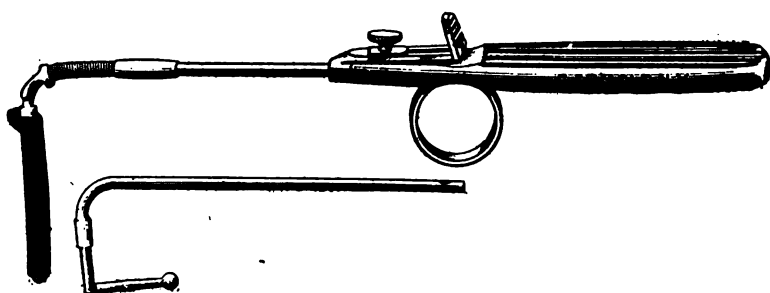


FIG. 58.—O'Dwyer tube, obturator and handle. (Koplik.)

of easy respiration. Cyanosis is usually immediately relieved. A silk thread is tied to the intubation tube on introduction and left hanging out of the mouth. If difficulty in respiration occurs within ten to fifteen minutes the tube may be withdrawn by means of the thread, otherwise the thread is cut and removed. For subsequent removal of the tube, a special pair of curved forceps, known as an "extubator," is required. During the operation of either intubation or extubation the child should be wrapped in a sheet and firmly held by the nurse and assistant. When the dyspnea has permanently disappeared (after two or three days to a week), the intubation tube may be removed, but it is sometimes



FIG. 59.—Introduction of the tube along the index finger. (Koplik.)



FIG. 60.—Introduction of the tube into the chink of the glottis. (Koplik.)

necessary to replace it after removal or after accidental displacement (ccugh). Sometimes the tube becomes clogged and must be removed for cleansing.

Cerebrospinal Fever.—Epidemic cerebrospinal meningitis (also known as cerebrospinal fever and spotted fever) is due to the *Diplococcus intracellularis meningitidis*, an organism so designated because it is found inside the pus cells of the exudate. The disease is endemic in this country, sporadic cases occurring from time to time without any very evident connection with each other. Severe epidemics also occur at comparatively long intervals, the most important one of recent years being that which had its chief centres in New York and Boston in 1904 and again in 1905. As a rule cases are seen late in the winter or in the early spring. Thus a small epidemic occurred in Philadelphia at this season in 1917. The disease is not common in the old or middle-aged, but is frequent in infancy, childhood, adolescence, and in young adult life. The organisms seem to enter through the respiratory tract, and infection occurs principally, if not entirely, by direct contact either with the patient or with "carriers," as in diphtheria. Infected objects (handkerchiefs, pillow cases, etc.) may occasionally convey the disease, but the meningococcus is fortunately very susceptible to drying, sunlight and simple disinfectants.

The disease affects the delicate membranes (leptomeninges) which closely invest the brain and spinal cord. The furrows, or sulci, on the lateral aspect and the depressions at the base of the brain, as well as the surface of the spinal cord, are covered with a creamy exudate. The cerebrospinal fluid which surrounds the spinal cord and fills the ventricles of the brain is increased in quantity and turbid with pus cells. The spleen is enlarged, but no other organs show any characteristic changes unless complications have been present. In this it differs from the secondary forms which are due to the pus cocci, to the pneumococcus, the influenza bacillus, the tubercle bacillus,

etc. In these forms, except the last, the symptoms are so similar to the disease we are describing that they will be merely alluded to in their proper sections. Tubercular meningitis is different in its manifestation and on account of its great frequency (70 per cent. of all meningitis cases in childhood, Holt), and its terrible mortality (nearly 100 per cent.), has been described elsewhere (p. 60).

Epidemic meningitis is characterized by a sudden onset, with severe headache, vomiting, fever, sensitiveness to touch, light, and sound, and general rigidity. Tremor and convulsions are common. In typical cases the head is held stiffly or drawn backward, the spine is rigid, the thighs flexed on the abdomen, the hands clenched and the feet extended. The patient generally lies on his side. Irritability is succeeded by delirium, stupor, and finally complete unconsciousness (coma). As a result of the loss of appetite and the mental state of the patient, food is difficult to administer and rapid emaciation occurs. Bed-sores are liable to develop because of the position and the poor nutrition of the patient. For the same reason congestion of the lungs, due to posture, frequently occurs. The pulse is at first rapid and weak, but may be slow at the last; the bowels are constipated. Intervals of seeming improvement occur and the fever which is at first high becomes very irregular. Irregular respiration or Cheyne-Stokes respiration, with which we are familiar in nephritis and myocarditis, is also common. Headache is a persistent symptom whenever the patient is conscious. On examination in addition to the posture we may notice inequality of the pupils, herpes on the lips, and occasionally scattered hemorrhagic spots on the chest and extremities. If the finger is drawn sharply across the skin a red line bordered by two white lines shortly appears. If the thigh is bent at right angles to the body it will be found difficult or impossible to straighten the leg on the thigh. This sign is known as Kernig's sign and is of considerable diagnostic importance. The disease lasts from three to six weeks or more. When death occurs it usually results

from exhaustion or some complication. If recovery ensues there may be a gradual return to normal conditions, but only too frequently paralysis, chronic hydrocephalus, or mental impairment is the sad legacy of the disease. There are rapidly fatal cases which terminate by death in a few days or hours, and cases which linger for several months. In the basilar meningitis of infants the duration is especially long. In these cases extreme retraction of the head is the most noticeable symptom. Mild cases also occur and in these the diagnosis may be difficult.

Of the laboratory examinations the most important is that of the cerebrospinal fluid. This is increased in quantity, cloudy in appearance, and contains the causative microorganisms. The fluid is obtained by lumbar puncture, an important method of diagnosis and treatment in this and other diseases. (See p. 34.)

The prophylaxis of the disease consists in a careful disinfection of the discharges or washings from the ear, nose, throat, and mouth, avoidance of direct exposure in case of cough, disinfection of clothing and bedding, and of discarded food and dishes. A nurse who is in prolonged contact with the patient should wear a gown, for although the danger of transmitting the disease is slight, the severity of the affection demands special care.

Treatment.—In a disease which frequently has a mortality of 75 per cent. treatment has until recently been more or less hopeless. Flexner's serum given early has reduced the mortality to 25 per cent. or less. Ten to thirty mils. are introduced by gravity directly into the spinal canal after a preliminary removal of an equal amount of fluid. The procedure is repeated once or twice daily for several days. This destroys the micrococci and, when the changes in the brain and cord have not gone too far, accomplishes remarkable results. Lumbar puncture is in itself a useful therapeutic measure, particularly for the relief of the terrible headache. Aside from these methods medical treatment is largely one of support and

stimulation. Good nursing is, however, very essential. The patient must be frequently turned and otherwise cared for to avoid congestion of the lungs and bed-sores. The nose, throat, and mouth require frequent cleansing with mild antiseptic solutions. The bladder and bowels will also need attention, as the patients are frequently unconscious. Sometimes the nurse will be able to administer sufficient food in the usual manner—at least the caloric equivalent of two quarts of milk and three eggs. At other times it will be necessary to resort to gavage. This is accomplished by means of a large catheter and a funnel. The catheter is passed through the nose into the esophagus; in some instances a stomach tube, passed in the usual way, is preferable. A pint or more of milk fortified with eggs and milk-sugar may be poured into the stomach two or three times a day. In patients who recover, massage and passive movements will be required, particularly if there have been any paralyses.

Pneumonia.—When we speak of pneumonia we usually mean lobar or croupous pneumonia, a malady which is caused by the pneumococcus¹ and is now regarded as a general infectious disease with its most prominent manifestation in the lungs. It is characterized by a definite febrile course and by physical signs indicative of the typical pulmonary lesions. It is modified in many respects in infancy and old age, in the course of acute or chronic complicating diseases, and in alcoholism. It is sometimes difficult to distinguish it from bronchopneumonia (catarrhal or lobular pneumonia) and other irregular types which are not specific infections but may be caused by a great variety of organisms as well as by the pneumococcus (croupous pneumonia is rarely due to other organisms). Croupous pneumonia is common from late infancy to middle age, while bronchopneumonia is most prevalent at the extremes of life and in debilitated

¹ Various types of races (Types I, II, III, etc.) of pneumococci are described which produce corresponding types of disease.

persons. Croupous pneumonia is said to constitute from 1 to 6 per cent. of all diseases and to cause from 9 to 10 per cent. of all deaths. The mortality of the disease in private practice is roughly 10 per cent., in general hospitals about 20 per cent., while in institutions which receive drunkards and subjects of chronic disease in large numbers it may rise to 50 per cent. or more. Pneumonia may therefore be said to be the most important of all acute infectious diseases. Ordinarily it is not very readily communicable, if precautions are taken with the sputum, being on a par in this respect with meningitis. An undue susceptibility is as important perhaps as the presence of the pneumococci themselves which are often tolerated by the healthy throat without apparent harm. In institutions and elsewhere the disease at times becomes actively infectious with deplorable results. The most recent explanation for these variations is that there are several distinct races of pneumococci with varying degrees of virulence and infectiousness.

At autopsy in typical cases an entire lobe is found consolidated. The lung contains no air and small excised pieces sink in water. The cut surface of the affected lobe is found to be of a deep red color and decidedly granular on account of the "croupous" exudate in the minute air cells. If the patient dies in the early stages of the disease the lobe may be intensely congested but not solid. If he dies very late in the disease the consolidated lobe is grayish in color, and the exudate has begun to soften preliminary to absorption. Only a small part of the exudate is ever expectorated.

The typical signs of pneumonia are caused by the congestion and consolidation. Crepitant rales are "sticky" sounds caused by the air entering and separating the walls of the congested air cells. The dulness on percussion is due to the physical state of the lung. A similar "note" may be brought out by tapping a large piece of meat while the normal sound has been compared to that elicited by striking the top of a loaf of bread. Bronchial

breathing is a sound normally heard over the bronchial tubes. In pneumonia this is "transmitted" directly to the ear while the soft, breezy sound normal to the little air cells is lost because they are completely filled up. A dry or fibrinous pleurisy almost uniformly accompanies the pneumonic consolidation, and is the cause of the severe pain and of the characteristic rubbing or scratching sound that is often heard over the diseased area. The pleurisy is usually dry, but in exceptional cases may be serous or purulent; in the latter case it constitutes a complication or sequel of some gravity. With convalescence the consolidated lung softens and is rapidly absorbed. During this stage dulness diminishes and bubbling sounds are heard over the lung. Sometimes resolution is long delayed. This may frequently justify the suspicion that the process is tuberculous rather than pneumonic. Pneumonia most commonly affects the lower lobes but the upper lobes are often involved in drunkards and in the aged. In many cases a whole lung is solidified and in others a large part of both lungs. Though pneumonia may attack one lobe after another there is seldom a true relapse. I have seen one case only. Repeated attacks of pneumonia are, however, very common, as the immunity which prevents a relapse appears to be very transitory.

Course of Disease.—The history and course of a typical case of pneumonia is somewhat as follows: An individual who may have been in perfect health, without preceding coryza or bronchitis, is seized with a violent chill. This is frequently attributed to a wetting or to other exposure. Following this high fever, rapid respiration, cough, and severe pain in the affected side supervene. The pain is sharp or stabbing and occurs with respiration. It is commonly felt in the chest, but may occasionally be referred to the abdomen and thus give rise to errors in diagnosis. The cough is at first unproductive but later tenacious, slightly blood-tinged ("rusty") sputum is brought up which adheres to the lips and is expectorated with difficulty. On microscopic examination this is

found to contain the causative organism. The fever now remains continuously elevated with a slight morning remission of little more than a degree, the respiration is nearly double its normal frequency (quite out of proportion to the fever), and the pulse, which is full and strong, is increased in proportion to the temperature. The blood-pressure when taken is found to be well sustained and the leukocytes are markedly increased (leukocytosis). The appetite, as in all fevers, is diminished and slight delirium is present, at least at night. The skin is flushed and it is commonly thought that the cheek on the affected side is redder than its fellow. Fever blisters (herpes) on the lips or nose are an almost constant finding. After five to nine days the temperature rapidly falls to normal (crisis), the respiration becomes easy, and if the leukocytes are counted a few hours later, they are also found to have returned to normal. This period of the crisis is usually accompanied by sweating, chilly sensations, and a tendency to weakness of the pulse, but in simple cases no treatment is required beyond a hot-water bag. The patient should, however, be carefully watched by the nurse and medical advice immediately sought at the least untoward symptom. Sometimes in otherwise typical cases there is a fall of temperature of a temporary nature just preceding the crisis (pseudocrisis). Convalescence proceeds rapidly and in another week the patient may be up and about. The signs of consolidation also disappear with surprising rapidity, but not so quickly as the symptoms would indicate.

Failure to develop a high leukocytosis usually denotes a poor resistance and a dubious outcome, or on the other hand, a very mild infection. Rapid pulse, low blood-pressure, and blueness indicate a failing circulation. A very full, high-tension pulse is sometimes considered an indication for bleeding; so also is intense cyanosis. Excessive pain on respiration is common in extensive pleurisy or pleuropneumonia. Brown or "prune-juice" sputum is found in severe alcoholic pneumonias. Jaundice is com-

mon in some epidemics, but does not in itself add to the gravity of the case. Abdominal distention is a condition that frequently develops and demands assiduous attention on the part of the nurse and physician. The urine, as in all severe fevers, is liable to be scanty and to contain a little albumin. In pneumonia it is important to maintain a free secretion for the purpose of eliminating the toxins as rapidly and completely as possible. With high fever and severe toxemia restlessness and delirium are aggravated. The delirium may be active or stupor may ensue. There are no typical eruptions and joint swellings occur only as complications or sequelæ. The course of the infection may show wide variations from the type. In children a convulsion may replace the chill at the onset. In other cases the onset may be insidious and patients may walk about during the greater part of the attack. The fever may be slight or in the aged even absent; it may pursue an irregular course and end by lysis. In other cases it may remain at a high level with severe general symptoms, or fresh accessions of fever may mark the successive involvement of lobes primarily unaffected. An irregular fever persisting after the beginning of convalescence usually points to some complication, most commonly empyema or tuberculosis.

Complications.—The possible complications are so manifold that we must limit ourselves to the most important. In some cases the course at first simulates pneumonia, but at the time of the expected crisis the fever becomes irregular and all the symptoms of tuberculosis develop. These cases are doubtless tuberculous from the onset, but it is frequently impossible to diagnose them except by their course. In other cases an irregular fever persists and with it the signs of fluid in the chest are made out. A definite diagnosis of empyema is usually made by exploratory puncture and the discovery of pus. Early treatment of empyema by drainage usually leads to excellent results, but neglected cases often develop septicemia and either die, or are "operated" late and recover with

deformity of the chest and a crippled lung. Exploratory puncture is usually made with a large antitoxin syringe or with an aspirator. A small hypodermic needle which will suffice for the diagnosis of a serous effusion is liable to become obstructed by pus; one of large caliber should therefore be provided. If the pus is "loculated" or shut off in a little pocket, it may be very difficult to locate and require repeated punctures, or even operation if the diagnosis is practically certain. A purulent effusion may also develop in the pericardium, the sac which surrounds the heart. The treatment is similar to that of empyema, but the outlook is much more serious. Endocarditis, abscess of the lung, gangrene of the lung, nephritis, meningitis, and arthritis are a few of the other complications that may develop. As mentioned at the beginning pneumonia may complicate many acute and chronic diseases and be profoundly modified by them. It is one of the commonest modes of death in the aged and in them the sign and symptoms are likely to be very obscure. The other forms of pneumonia are described under Diseases of the Lungs.

Treatment.—The preventive treatment of pneumonia is simple and consists merely in the disinfection of the sputum and of utensils and linen that may have been contaminated by it. If the disease shows an epidemic tendency, more elaborate disinfection should be carried out, and after convalescence the usual cleansing and fumigation of the room or ward should be undertaken. Pneumonia patients are frequently treated in the wards with other patients, but it is good practice to keep them in separate rooms, both for the protection of susceptible subjects and the more efficient carrying out of the treatment. This is the practice in the Philadelphia General Hospital and other large institutions where many cases are almost constantly under observation.

Serums and antitoxins have been used in pneumonia, generally with little success. Recently serums prepared to combat distinct "types" of pneumococci have been

widely used, with encouraging results. Some physicians employ venesection in robust patients if they are seen at the onset. Quinin and other drugs have also been lauded as specifics, but the majority of physicians use a treatment which is largely expectant ("watchful waiting"). Simple diuretics (including water) are used to encourage elimination and stimulants are administered when needed, particularly at the time of the crisis. Expectorants are not required in croupous pneumonia, though they have a place in bronchopneumonia. Sedatives are used, when other means fail, to relieve pain or to check excessive cough.

For the pleuritic pain the ice-bag, dry cups, and strapping are most efficient; poultices, and their modern equivalents made of clay or chalk and glycerin, are less desirable on account of their weight, inconvenience of application, and interference with examinations. Other applications less used now than formerly are the local pack (compresses wet in water and covered with oiled silk), the cotton jacket, the mustard pack, camphorated oil, and blisters. A light woolen shirt is probably as efficient as the cotton jacket and is decidedly more comfortable; frequently nothing but a muslin nightgown is worn.

For the distressing tympanites which often threatens the patient's life by interfering with respiration, the hot-water bag, turpentine stupes, rectal tube, and enemas are used. A change in diet—omission of milk—and certain drugs are also beneficial.

To control excessive temperature and to stimulate the respiration and the nervous system, sponging and packing are excellent. Treatment in the cold, open air has much the same effect if the coverings during the febrile stage are kept as light as is consistent with comfort. Hydrotherapy is hardly practicable in improvised open-air rooms or wards but may be employed if there is a warm retiring room. If the patient is treated indoors the room must not merely be ventilated, but there must be

an unlimited supply of pure, cold air streaming through it. In bronchopneumonia, as seen in the aged and in children, on the other hand, the temperature should perhaps be kept up to 65° and good ventilation provided. Other methods which may be mentioned are hot mustard foot-baths for adults and full mustard baths for children. The latter are used to promote reaction in cases with severe respiratory distress and cyanosis. Alternating hot and cold baths or affusions are also used for the same purpose.

It is hardly necessary to insist on absolute rest in bed, the use of the bed-pan and the administration of a liquid diet with a great abundance of water, lemonade, or similar beverages. The excess of fluids is intended to secure a free diuresis and prompt elimination of toxins. When convalescence begins, a rapid return to soft and solid diet, largely regulated by the appetite of the patient, is in order.

Influenza (Grippe).—Several diseases are confused under the term influenza. True influenza is due to the influenza bacillus and occurs in wide-spread epidemics which are often world-wide and are therefore known as pandemics. These occur at comparatively long intervals, but local epidemics are of constant occurrence. The latter are not always and perhaps not generally due to the same bacterial cause, but may be brought about by a variety of organisms, pneumococci, streptococci, etc. In their general symptoms they bear a strong resemblance to the true influenza. They are often distinguished by the terms "grippe," influenza nostras, or influenzal cold. The best-known epidemic of influenza in the present generation began in Russia in 1889 and within a few months spread over the whole civilized world. The rapidity with which the disease spread, at first gave rise to the idea that it was due to some atmospheric condition, but a more careful consideration and a study of previous epidemics showed that its progress was not more rapid than the means of modern travel would

explain (Osler). The disease is contagious and very few people seem to be immune. It is probably communicated by direct contact. The disease affects primarily the respiratory system, but nervous and gastro-intestinal forms are described in which the principal stress seems to fall upon those systems. One attack does not protect the individual but renders him more susceptible to repeated infection.

The disease begins suddenly and is attended with symptoms of extreme prostration, severe headache, back-ache, and aching in the limbs. There is moderate fever and some increase in the rapidity of the pulse. With these symptoms there is cough, coryza, injection of the conjunctiva, and in the gastro-intestinal form, diarrhea. In the course of a few days the symptoms subside and convalescence begins. In spite of the apparent mildness of the disease recovery of health and strength is often slow. In the aged and infirm complications are frequent, particularly bronchopneumonia, nephritis, meningitis, and mental disturbances.

Treatment as a rule is largely hygienic. The patient should be kept strictly in bed and protected from cold to which patients with this disease are peculiarly sensitive. On this account it is well to use a flannel nightgown. The diet should be liquid in the febrile stages and afterward as nutritious as the condition of the patient's stomach will permit. Where circumstances allow a prolonged rest or vacation is advisable. The pains in the acute stages may be relieved by the use of hot-water bags or other local applications, and by the administration of salicylates, phenacetin, and codein. These remedies are to be used with caution in the weak and debilitated. If it were practicable isolation would be advisable in all cases, but in wide-spread epidemics this is usually impossible, and it must suffice to guard the young, the infirm, and the aged as far as possible from contact with affected persons. That isolation may be effectual is proved by the fact that prisons and other institutions

have frequently escaped infection, even in wide-spread epidemics.

Whooping-cough.—Whooping-cough or pertussis, is an infectious disease of early childhood, although adults and particularly the aged are occasionally attacked. It is probably due to a bacillus which has recently been described by Bordet. This organism is found in the plugs of mucus which the patients spit up after a paroxysm. The disease is actively contagious and is acquired by close contact with a case in the acute stage, rarely, if ever, through a third person. It is easy to imagine that the atmosphere surrounding the patient may be surcharged with suspended droplets after a "kink." The incubation is from one to two weeks. There are no distinctive pathological changes in the organs.

After a week or two of apparently simple bronchitis, which may be accompanied by slight fever and associated symptoms, the cough becomes spasmodic and soon develops its typical character. This second or paroxysmal stage may last for a month or more. The paroxysms may be only occasional or they may be very frequent throughout the day and night. In typical cases a child gives a series of spasmodic coughs in the intervals of which he is unable to take a full breath. The face becomes congested and bluish and the eyes prominent. Children often run to their mothers or nurses as if for protection. At the culmination of the attack the child takes a deep inspiration which is accompanied by the characteristic whoop. When the attacks are frequent exhaustion may be pronounced, particularly as the child always vomits whatever food may be in its stomach at the time. This paroxysmal stage is succeeded by a stage of decline lasting two weeks or longer. During this period the cough usually retains some spasmodic element. The total duration of the disease is not often less than a month or six weeks and it may last for many months if conditions are unfavorable. Recovery is more prompt in the spring and summer when the child can remain constantly in the open air. The diagnosis in mild cases in which the whoop

is poorly marked is at times difficult and may depend on the history of exposure. While the disease in itself is not serious, its complications make it one of the most fatal affections of infancy. Hemorrhage is one of the most frequent complications. This may take the form of nosebleed, it may be subconjunctival, the whole white of the eye becoming of a deep red color, or it may occur in the membranes of the brain. The last is a most serious form and may occasion a paralysis (monoplegia) whose extent and distribution will depend on the size and situation of the blood-clot. I recall a case in which paralysis of one arm was due to this cause. Bronchitis and bronchopneumonia are the most fatal complications and are all too common in young children. Vomiting and emaciation have been mentioned. Convulsions may also complicate pertussis and may be a cause of death.

Prophylaxis and Treatment.—Children attacked by whooping-cough should be isolated at once, as the disease is contagious from the beginning. Quarantine should be maintained at least until the end of the paroxysmal stage. The child, however, should not be kept in the house, but should be allowed to go out of doors and only restricted as regards its association with susceptible children, that is, those who have not had the disease. The treatment consists in keeping the child as much as possible in the fresh air and in maintaining the nutrition. When practicable city children should be sent to the country, but in winter time the fresh-air treatment should not be pushed to an extreme on account of the susceptibility of these patients to pneumonia. The child should be protected by light woolen clothing or underclothing as in other catarrhal affections. Some physicians find a tight abdominal belt of benefit in limiting the paroxysms. Vaccines are now being employed both in prophylaxis and treatment. Medicinal treatment is almost wholly sedative and should be confined to those cases in which the number of paroxysms is excessive. Drugs such as antipyrin, bromides, and monobromate of camphor are types of those ordinarily employed.

CHAPTER V.

INFECTIOUS AND PARASITIC DISEASES— CLASS III.

A. BACTERIAL DISEASES (Continued).

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| TUBERCULOSIS. | |
| Distribution of Tuberculosis in the Body. | Incipient Tuberculosis of the Lungs. |
| Glandular Tuberculosis. | Chronic Fibroid Phthisis. |
| Miliary Tuberculosis. | Chronic Ulcerative Tuberculosis. |
| Galloping Consumption. | Prophylaxis of Tuberculosis. |
| | Treatment of Tuberculosis. |
| | LEPROSY. |

TUBERCULOSIS AND LEPROSY.

Tuberculosis.—Tuberculosis may be regarded as the most important of the chronic infections. It affects not only man, but many species of animals. In the human subject, practically every organ and tissue of the body may be involved. It is therefore of importance in every department of medicine, but from the purely "medical" point of view pulmonary tuberculosis occupies the place of chief importance. The symptoms of tuberculosis are produced by the action of the tubercle bacillus and its toxins. In advanced cases of tuberculosis, whether of the lungs or of other organs, secondary infection as we shall see is frequently responsible for the high fever, sweats, and chills, often regarded as peculiarly characteristic of tuberculosis itself. These secondary invaders are the ordinary pus organisms, the pneumococcus, and perhaps the influenza bacillus. Two varieties of tubercle bacilli are found in human beings, the human type and the bovine type. These seem to be more or less distinct

the one from the other and possess special predilections for certain structures. The human type is the one commonly found in tuberculosis of the lungs and is communicated from person to person. The bovine type is ingested with the food and particularly with milk, and probably gives rise to most of the glandular tuberculosis in children.

Tuberculosis is probably rarely, if ever, hereditary; the prevalence of the disease in certain families is more reasonably accounted for by the inheritance of a frail constitution and by exposure to infection in childhood. Dissemination of the tubercle bacillus is principally due to the sputum and to other discharges given off by the affected patient. As a rule the disease is acquired by very intimate association since the bacilli do not long survive the effects of light and drying; nevertheless the danger of dust should never be ignored. Tubercle bacilli are also eliminated in the urine and feces. Another source of infection is from the milk and meat of tuberculous cows, and although this is not as important as it was once believed to be, nevertheless meat should always be well cooked and milk for children should be obtained from tuberculin-tested herds (pasteurization, however, kills the tubercle bacillus). It seems possible that many infections may take place in childhood and afterward remain latent until some intercurrent disease or chain of circumstances overcomes the immunity which the patient has acquired. A large proportion of all adults harbor tubercular lesions, however slight, in some part of the body. These, as a rule, are walled off completely, but suffice to induce a certain degree of immunity and to protect the patient from ordinary minimum amounts of infected material. Before taking up pulmonary tuberculosis in its various aspects, a brief summary of the other forms that tuberculosis may assume is in order.

Distribution of Tuberculosis in the Body.—Respiratory tuberculosis includes tuberculosis of the pleura, and tuberculosis of the lungs. Gastro-intestinal tuberculosis occurs

principally in the form of tuberculous ulcers in the small intestine. Occasionally the cecum is affected, leading to the formation of a tumor-like mass. Tuberculosis of the intestine is frequently, but by no means invariably, associated with intractable diarrhea. It is commonly a sequence of advanced pulmonary tuberculosis. In intestinal as well as in miliary tuberculosis tubercles are frequently found in the liver. Tuberculosis of the peritoneum is a common variety and one that is often susceptible to cure by operative interference. Tuberculosis of the kidney is a common manifestation, one kidney being usually more diseased than the other. It may be associated with stone. Bladder tuberculosis is also found in these cases. Tuberculosis of the ovary is a common starting-point for tuberculous peritonitis in women, while tuberculosis of the testicle and epididymis is frequently responsible for miliary tuberculosis (meningitis) in men.

Tuberculosis of the bones and joints is common in childhood. In the large joints it is known as "white swelling." Pott's disease (tuberculosis of the spine) and hip disease belong to this group. In these cases the bone frequently breaks down with the formation of "cold abscesses" (*e. g.*, psoas abscess). **Glandular** tuberculosis is most frequently observed in childhood and attacks by preference the glands of the neck. The infection in many cases makes its way through the tonsils (disputed). The glands, which are at first discrete tend to fuse together as the disease progresses, to undergo cheesy degeneration, and finally to break down and suppurate. This condition accounts for most of the irregular and ragged scars seen in the necks of adults. At the present day serious scarring is prevented by *x*-ray treatment or excision. Tuberculosis of the bronchial and mesenteric glands is less readily diagnosed. The former may be a cause of obscure coughs in childhood. In the abdomen the condition is known as "tabes mesenterica." These lesions of the bones, joints and glands, were formerly spoken of as scrofula. They are discussed in works on

surgery. The heart and bloodvessels are infrequently attacked by tuberculosis. Tuberculous pericarditis is, however, not uncommon and is often associated with tuberculosis of the pleura and peritoneum. Tuberculosis of the nervous system is commonly manifested in the form of tubercular meningitis. Tuberculosis of the skin occurs in two principal forms, the anatomical wart which is due to accidental inoculation in the performance of autopsies, etc., and lupus. The latter is an extremely disfiguring and mutilating disease of the skin which pursues a decidedly chronic course.

The following forms of tuberculosis will be considered in more detail in this section: Miliary tuberculosis, phthisis florida, incipient pulmonary tuberculosis, chronic fibroid phthisis, and chronic ulcerative tuberculosis of the lungs.

Miliary Tuberculosis.—Miliary tuberculosis is a form of tuberculosis in which tubercles are distributed not only throughout the lungs, but through practically every organ of the body. As a rule the distribution of the disease throughout the system follows the breaking down of some old latent focus with invasion of the bloodvessels or lymphatics. Sometimes a bronchial lymphatic gland will open into a small bloodvessel and the patient who has hitherto had a few or no symptoms, will suddenly show evidence of severe infection. Old cases of hip disease or Pott's disease, which may have been latent for many years, may suddenly develop signs of miliary tuberculosis (meningitis) and terminate fatally within a few weeks. The term "miliary" is applied to this condition because the infection is so rapid that the tubercles as a rule do not progress beyond the miliary stage, and appear as pinhead-sized to pea-sized gray or yellow nodules, scattered through all the organs. The symptoms depend largely upon the distribution of the tubercles. If these involve the meninges at the base of the brain, the symptoms are predominately those of meningitis. In the ordinary form the lungs and other viscera are involved early

in the disease while the meningitis is a late development. The individual lesions are so minute that the ordinary methods of physical examination may give no definite information, the only signs being those of bronchitis.

The general course of the disease resembles very closely that of typhoid fever, and frequently it is impossible for many weeks to distinguish the two infections. In miliary tuberculosis the mind is usually clear and the temperature shows decided daily variations. The pulse is often more rapid than we would expect in typhoid fever. In the earlier stages the laboratory examinations employed by the physician are of little assistance except the Widal reaction and blood cultures. These if persistently negative exclude typhoid.

Galloping Consumption.—Another form of rapidly fatal tuberculosis is phthisis florida or “galloping consumption.” This begins suddenly with all the symptoms of ordinary pneumonia. Frequently the patient may have been in failing health prior to the onset of the acute disease. At the end of a week or ten days the so-called pneumonia does not clear up, the temperature is persistent and irregular; and in time, signs of cavity formation and the expectoration of sputum containing tubercle bacilli confirm the diagnosis. These patients usually die in a few months, although it is possible for the disease to assume a more chronic form.

Incipient Tuberculosis of the Lungs.—This is not a distinct form of the disease, but the early stage of the chronic ulcerative type. If the presence of beginning disease at the apex is recognized sufficiently early, patients may recover complete health if treated by fresh air, rest, and proper feeding. These measures will be discussed in detail below. The suspicion of tuberculosis should be awakened by a persistent cough, even of slight degree, loss of weight, digestive disturbances or anemia without obvious cause. Suspicion in these cases will be strengthened if the temperature is found to show a slight evening rise.

Chronic Fibroid Phthisis.—In patients who recover from tuberculosis, the focus of disease is surrounded by connective tissue and the actual lesion itself may be converted into a calcareous or chalky nodule. In persons with more extensive involvement but with a high degree of resistance, fibroid induration of a whole lobe or lung may occur. This may limit the spread of the disease, but does not bring about complete recovery or latency. In these cases chronic bronchitis persists for ten or twenty years or longer. A large part of the lobe or lung may be involved by the tuberculous process and many of the bronchial tubes may be dilated (bronchiectasis) as a result of the chronic cough. The chest is frequently deformed by the partial collapse of the affected portions of the lung. The patients become emaciated and finally die either from the progress of the disease itself, or more commonly from some complicating or intercurrent condition.

Chronic Ulcerative Tuberculosis.—Chronic ulcerative phthisis is the ordinary form of pulmonary tuberculosis. It is characterized by more or less extensive areas of consolidation in the lung, which tend to break down with the formation of pus-containing cavities. As a rule the pleura which overlies the diseased lung is affected, and after a number of attacks of acute pleurisy the lung becomes more or less generally adherent. Occasionally a cavity ruptures into the pleura, and air, or air and pus fills that sac (pneumothorax or pyopneumothorax).

The destructive process in the lungs is prone to involve the smaller bloodvessels and occasionally a large artery may be exposed. As a consequence slight or massive hemorrhages are one of the commonest features of the disease and may occur at all stages. The hemorrhage, as a rule, does not prove fatal. In the more advanced cases there is a strong tendency to involvement of the larynx. In cases in which the larynx is primarily or secondarily involved, the course is usually rapidly downward. Tuberculous ulceration of the small intestine is

also a common complication in advanced cases. This is not invariably attended by distinctive symptoms, so that the diagnosis is often in doubt. Anemia is an early manifestation of the disease and is characterized by a disproportionate reduction in the coloring matter of the blood, so that the pallor of the patient suggests a greater reduction in the blood count than is found to exist. Night-sweats and hectic fever, which have long been considered as characteristic of tuberculous infection, are to be attributed to secondary infection with other bacteria. As long as the process is purely tuberculous the diurnal variations in temperature are comparatively slight. One of the benefits of the open-air treatment is that it tends to minimize secondary infection and thus to prevent the development of the typical hectic stage.

The Prophylaxis of Tuberculosis.—The prophylaxis of tuberculosis in its widest sense would include almost the whole domain of preventive medicine, as tuberculosis is favored by almost all unhygienic conditions: overcrowding, lack of sun and fresh air, lack of cleanliness, insufficient and improper food, lack of exercise in the open air, etc. It has been found that the incidences of tuberculosis is considerably greater in certain houses in which sunlight and ventilation are particularly defective. With the clearing up of the slums in some modern cities the death-rate from tuberculosis has rapidly diminished. Persons who are predisposed to tuberculosis, not to mention others, should be housed in buildings freely exposed to fresh air and sunlight and free from dampness. The food should be of a nourishing quality and should include an adequate amount of fat and protein.

Treatment of Tuberculosis.—The treatment of pulmonary tuberculosis consists essentially in rest, fresh air, and an abundant supply of nourishing food. Climate, exercise, tuberculin, and drugs occupy an important but secondary position.

Consumptives were formerly advised to go into the open, and live a life of active exertion—riding horse-

back, camping, tramping, etc. According to our present ideas this treatment was bad and suited only to a few exceptional cases. At present patients with fever or rapid pulse are kept absolutely at rest in bed. When the acute symptoms disappear greater activity is gradually permitted and finally a certain amount of work is prescribed. This is systematically increased and the patient is not considered fit for discharge until he is able to perform his usual work without unusual fatigue. In some instances work is prescribed with the idea of causing a slight febrile reaction (auto-inoculation with the tuberculous toxin).

Fresh air is a very important agent in the treatment of this disease. Where it is possible, a well-screened sleeping porch or tent should be arranged in the yard or on a roof or balcony. When the weather conditions permit (that is, rain or snow) the shelter should be completely opened at least on two sides so as to allow a free circulation of fresh air. Tents closely battened are worse than ordinary rooms. Cold, dry air is undoubtedly more beneficial than warm or damp air, except perhaps in tuberculous laryngitis, but this should not deter the patient from taking full advantage of the best that is available.

Climatic treatment is not so popular now as formerly because the undoubted advantages of altitude and dry air, etc., are in many cases counter-balanced by the inability to procure good food, and by unsuitable quarters, home-sickness, etc. Most of the advantages of distant climates may be obtained near home—in the country, mountains, State or national forests, or at the seashore. Sea air is especially valuable for those who are suffering with the glandular and bone lesions ("scrofula").

The most convenient diet and the one ordinarily employed consists largely of milk and eggs. Patients at partial rest may be given three quarts of milk a day corresponding to two thousand calories, half a dozen eggs representing nearly five hundred calories, and a substantial meal making up the total to three thousand. Very often four or five thousand calories a day are adminis-

tered, but the advisability of excessive hypernutrition is being questioned. More difficult to arrange but perhaps preferable is a diet made up of ordinary articles of food



FIG. 61.—Outside sleeping room. (T. S. Carrington.)

without large quantities of milk and eggs. The object to be kept in view is the maintenance of nutrition and increase in weight up to normal standards. Allowance must always be made for the loss of a certain amount of fat when active exercise is resumed.

Tuberculin treatment consists in the repeated injection of minimum doses of tubercular toxins obtained by grinding and suspending killed tubercle bacilli. When tuberculin was first introduced, many years ago, comparatively large doses were employed with results which in most cases were far from happy. This led to its abandonment except for diagnosis. The injection of a moderately large dose of tuberculin in a person or animal possessing a focus of infection anywhere in the body causes a sharp febrile reaction. This is constantly used in the case of cattle in order to diagnose the presence of the infection. In human beings it is employed for the same purpose, but less often than formerly, on account of the discovery of less troublesome modes of applying the test. Von Pirquet discovered that if a little tuberculin was rubbed into an abrasion on the arm, a local reaction, with redness and slight swelling, would appear in a day or two if the patient were infected with tuberculosis. Calmette employed a similar reaction in the conjunctiva, but this is now little employed on account of the possible danger of injury to the eyes. The diagnostic value of these and several similar methods is impaired by the fact that the majority of adults have tuberculous foci, latent or otherwise, somewhere in the body. They are, however, of great use in children. This leads to the modern use of tuberculin for treatment, which consists in the use of very minute doses administered hypodermically at suitable intervals over a long period of time. The dose is gradually augmented as the patient's tolerance is increased. Each injection is adjusted to call forth a minimum reaction. In this manner the patient develops a resistance to the tubercular toxins which may enable him to overcome and localize the infection. The effect of large

doses is to overwhelm the defensive forces of the body and to facilitate the rapid process of the disease. Patients with active tuberculosis who indulge in excessive exercise probably absorb similar poisons from their own diseased tissues and so encourage the progress of the disease.

The medicinal treatment of tuberculosis is disappointing. Innumerable drugs have been proposed as specifics, but none of them has held a permanent place except cod-liver oil and perhaps creosote. The former is to be regarded purely as a food. The latter administered in small doses may relieve both dyspepsia and bronchitis. Enormous doses of creosote were formerly prescribed, but these are now little used. Iodin preparations of various kinds are credited by some with curative properties; they are frequently administered by inunction. Other drugs are used symptomatically, *e. g.*, codein for excessive cough, nux vomica for anorexia, iron for anemia, etc.

These and other methods of treatment may be carried out in the patient's home or in a sanatorium. A short residence in a well-regulated institution is often of great benefit in instilling into the patient the importance of a careful and systematic carrying out of all the details of the treatment. Patients who cannot command the necessary facilities for open-air treatment at home can remain, with benefit, in such an institution during the whole course of treatment. Sanatoria are also valuable as refuges for advanced cases, at the same time securing a certain degree of comfort for the patients and protecting the general public from infection.

Leprosy.—The disease that we now call leprosy is probably not identical with that described in the Old Testament, which, according to the best authorities, included other skin conditions, and particularly psoriasis. The disease prevails extensively in tropical countries and sporadically in northern latitudes. In this country there are local foci of disease in the Northwest, whither it has been brought by Scandinavian immigrants, and

in Louisiana. It is also prevalent in Hawaii and the Philippines. The leper colony in the former place is



FIG. 62.—Anesthetic leprosy with mutilating results. (From a photograph of a leper in the Sandwich Islands.) (Ormsby.)

particularly famous. The disease is due to an organism which in many respects resembles the tubercle bacillus,

and is probably transmitted in a similar manner.¹ The popular exaggerated dread of contagion is unwarranted, as physicians, priests, "sisters," etc., have lived for years in comparatively close contact with cases without acquiring the disease; not all have been so fortunate. Its contagiousness is probably on a par with that of tuberculosis. Leprosy occurs in two forms, which are, however, frequently combined. The nodular form begins as red spots in the skin, from which nodules develop particularly about the face, knees, and elbows. The lumpy appearance in the face has given rise to the designation of "lion-faced." In the other type nodules occur in and along the nerves, causing in the beginning pain and later anesthesia. As a result of interference with the nerves the fingers and toes slough off and deep intractable ulcers occur. The disease is extremely chronic and apparently incurable. Death may result, however, from some complication or intercurrent disease.

¹ Some authorities suspect that the bed-bug is responsible for the transference of this disease.

CHAPTER VI.

INFECTIOUS AND PARASITIC DISEASES— CLASS III.

B. DISEASES OF UNCERTAIN OR UNKNOWN CAUSATION.

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| INFANTILE PARALYSIS. | MEASLES. |
| FOLLICULAR TONSILLITIS AND QUINSY. | Propylaxis and Treatment. |
| Treatment. | GERMAN MEASLES. |
| GLANDULAR FEVER. | SCARLET FEVER. |
| RHEUMATIC FEVER. | Course. |
| Course. | Propylaxis and Treatment. |
| Diagnosis and Prognosis. | SMALLPOX OR VARIOLA. |
| Treatment. | VACCINIA. |
| MUMPS. | CHICKEN-POX. |

Infantile Paralysis.—Acute poliomyelitis has only come into prominence as an epidemic disease in the last twelve to fifteen years, first in the Scandinavian countries, later in other parts of Europe and in America. Prior to that time sporadic cases had attracted attention almost solely on account of the paralytic phenomena, the symptoms suggestive of infection being usually so mild as to escape observation. As time has gone on, however, epidemics have increased in severity—culminating in that of 1916 in New York and neighboring States—and the infectious features have come more and more into prominence. As an evidence of this change of view-point the paralyzes are now regarded as frequent complications rather than essential or invariable accompaniments of the disease.

About eight years ago the disease was reproduced experimentally in monkeys by the inoculation of material from patients dead of the disease. Since that time the virus

has been successfully cultivated on artificial media. The causative organism, like the unknown agents which cause vaccinia and rabies, are so minute that they are invisible under the ordinary microscope and readily pass the finest filters. The virus is easily destroyed by ordinary antiseptics—*e. g.*, 1 per cent. peroxide of hydrogen or 1 per cent. menthol in oil—but like vaccine virus resists the action of glycerin (Rosenau). The infectious agent is found on the mucous membranes of the nose and throat and of the gastro-intestinal tract, as well as in various internal organs and in the tissues of the central nervous system. The infection is probably disseminated by the discharges from the nose and throat, though the agency of insects (stable fly) cannot be excluded. Healthy "contacts," abortive and convalescent cases seem to play a part in disseminating the infection. The principal pathological lesions are found in the ganglion (motor) cells of the spinal cord—hence poliomyelitis. The disease usually attacks infants or young children though adults are occasionally attacked.

Symptoms.—In typical cases of poliomyelitis the course of the disease is sharply divided into two stages (compared to the humps of a dromedary by Draper) separated by a longer or shorter interval (a few hours to a few days) of apparent health. In some cases the symptoms remit but do not disappear. In abortive cases the first stage alone is present. Such cases can only be recognized in the course of an epidemic. In other cases the onset is with the nervous symptoms of the second stage. The symptoms of the first stage are not characteristic. Usually there is slight fever, flushed cheeks, heaviness, coated tongue, constipation or there may be local symptoms; sore throat, cough, vomiting or diarrhea. The symptoms of the second "hump" are related to the nervous system: fever, headache, irritability, convulsions, hyperesthesia, tenderness and rigidity of the back ("spine sign"), altered reflexes, muscular weakness and paralyses. Facial palsy is common and so are irregular paralyses

of the extremities. In fatal cases paralysis of the respiratory muscles is common. The acute symptoms are often of short duration but the paralyses persist, though the ultimate loss of power is much less than would be expected at first. The muscles permanently paralyzed undergo atrophy. One attack of the disease gives a high degree of immunity.

Treatment.—Prophylaxis should be principally directed to the disinfection of discharges from the nose and throat and to the isolation of contacts and convalescents. Disinfection of urine and feces, destruction of food remnants and careful screening against flies should also be practised, in short all the precautions that would be employed in the acute exanthemata. Nurses and other contacts may spray the nose and throat with peroxide solution, one part to two of water.

The management of the first stage is the same as that of any mild fever. In the second stage early and repeated lumbar puncture is a valuable diagnostic (increase of cells) and therapeutic measure. Immune serum, obtained from persons who have passed through an attack of the disease, is frequently injected into the spinal canal after lumbar puncture and in some cases seems to have a favorable effect. Occasionally severe headache, respiratory distress, etc., may follow such an injection. Under these circumstances the physician should be immediately summoned and needles made ready for lumbar puncture. Other methods of treatment, including the injection of adrenalin chloride, are at present *sub judice*.

After the acute stage has passed the physician will make use of measures designed to restore the greatest possible degree of function to the paralyzed muscles. These include strychnin, massage, passive movements, gymnastic exercises, electricity and hydrotherapy (salt baths). Among the poor the mother may be taught to use massage and employ suitable movements, but in the well-to-do this task will fall to the nurse or masseuse. Faradic (electric) stimulation is often of great use in

restoring the affected muscles. Occasionally the galvanic current may be required. In the later stages, when complete atrophy has occurred, orthopedic procedures are in order. In a general way these include the use of various forms of apparatus and operations. In the last few years surgeons have been successful in restoring partial or complete use of paralyzed limbs by the transplantation of tendons. This is possible because not all the muscles of a part are affected.

Follicular Tonsillitis and Quinsy.—Acute tonsillitis is an infection which is probably due to a modified streptococcus, similar to, or identical with that which causes acute articular rheumatism. The close relation which exists between recurring follicular tonsillitis and rheumatism is a medical truism. The various forms of tonsillitis may be due to distinct microorganisms, or to microorganisms of the same kind but of varying virulence. The marked variations in the severity of the disease and particularly in its communicability are sufficient evidence of this statement. Most cases are only slightly contagious, while others deserve the designation of epidemic or septic sore throat (the pharynx is also involved).

Tonsillitis is of three general types, features of all of which may be, and usually are, combined in individual cases. In one type the "pits" (follicles, lacunæ, crypts) in the tonsils are primarily involved. They are filled with a yellowish-white exudate which may be limited to them or may spread over the whole surface of the tonsil. Unlike the membrane of diphtheria it does not spread beyond the tonsil and is easily detached with a probe or applicator. In a second type (parenchymatous) the tonsil is diffusely swollen and infiltrated, while in a third, quinsy, the inflammation involves the tissues which surround the tonsil and usually terminates in suppuration. In almost all cases of any severity the pharynx is more or less inflamed.

Ordinary follicular or lacunar tonsillitis begins with severe headache, backache, and general pains in the

limbs. There may be a decided initial chill. The temperature rises immediately to 102° to 104° and the pulse is rapid, full, and strong. The throat may not be sore at first but is usually slightly reddened. By the second day the follicular deposits are well marked. The involvement is bilateral. In severe cases there is local pain which may be referred to the ears, and difficulty in swallowing solids. After two or three days to a week the temperature falls by crisis and the patient rapidly recovers. In the parenchymatous type the local symptoms are more pronounced. The follicles are not especially involved, but there may be small abscesses in the substance of the tonsil or tonsils.

Quinsy (suppurative tonsillitis) is a much more distressing affection. It may complicate or follow an ordinary attack of acute tonsillitis or it may arise independently. The local symptoms are similar to those of tonsillitis but are much more marked. The swelling of the affected parts together with the profuse secretion of mucus and saliva causes considerable interference with breathing. The patient is usually unable to take solid food and even the swallowing of liquids causes great distress. Some persons can hardly open the mouth on account of the swelling of the tissues and glands about the angle of the jaw. Unlike follicular tonsillitis the disease is unilateral, or one tonsil after the other is involved. The temperature is moderate but irregular and disappears when the abscess has opened, whether spontaneously or following incision. The duration is indefinite—a week more or less.

Treatment.—Cases of acute follicular tonsillitis require, as a rule, very little local treatment beyond the usual toilet of the mouth and teeth. An alkaline spray is useful to rid the tonsils and throat of mucus. Internally a preliminary saline followed by salicylates, or a solution of potassium chlorate and chloride of iron, suffices in most cases. If the initial pain and headache are very acetphenetidin (phenacetin) or some similar drug. An ice-bag or hot applications ex-

grateful to many patients. In quinsy more active local treatment is required. A free use of alkaline sprays, gargles, and mouth washes aids the patient in getting rid of the large quantities of mucus. When suppuration has occurred early, incision into the peritonsillar tissue shortens the attack.

Persons who have had repeated attacks of tonsillitis and quinsy may exhibit glands which are pitted with deep unhealthy follicles and deformed by scar tissue. In these cases operation may remove cryptic (hidden) infections which are responsible for acute (rheumatic) or chronic articular disease (arthritis deformans).

Glandular Fever.—Glandular fever is an acute febrile affection, occasionally seen in children, which is characterized by fever of short duration, mild, constitutional symptoms and general glandular swelling. Very little, if any, treatment is necessary.

Rheumatic Fever.—Rheumatic fever, which is also known as acute articular or inflammatory rheumatism, is an infectious disease of uncertain causation. It is probably due to streptococci which have acquired a special predilection for the joints and other serous surfaces (endocardium, pericardium, pleura). Prolonged growth in the crypts of the tonsils or in other hidden places seems to modify the streptococci so that they attack these special structures and lose their power to produce general inflammatory conditions. This hypothesis is worthy of mention, because it may explain the frequent incidence of rheumatism in persons who have been repeated victims of follicular tonsillitis. Although the disease is infectious and is present in epidemic proportions in the late winter and early spring, we do not know enough of its transmission to take any precautionary measures, aside from the avoidance of undue exposure to wet and cold, and the effectual treatment of attacks of sore throat and tonsillitis (and of the tonsils in many cases). I have seen many persons greatly benefited by

"Rheumatism" attacks children and young adults by preference but frequently recurs in later life. Primary rheumatic attacks in middle-aged and old persons seem to be mild and atypical in their manifestations. They are frequently simulated by the various forms of arthritis which are so common at that age period. Males (particularly coachmen, drivers, carters, longshoremen, etc.) seem to be more liable than females on account of their greater exposure to the elements. Cold, moist climates and damp and badly heated houses also predispose to the disease (England). Certain families also consider themselves rheumatic, though here there is much uncertainty on account of the failure to distinguish gout, rheumatism, arthritis, muscular "rheumatism," etc.

Course.—Rheumatic fever usually begins suddenly after a chilling or thorough wetting. I remember sleeping in a long-unoccupied, chill, "spare-chamber" at a farm house where I visited in childhood and waking in the morning with joints so swollen and tender that I was barely able to crawl down to the heated part of the house. Untreated the disease lingers for an indefinite period, usually of several weeks, and is accompanied by irregular, but not very high, fever and by sweats. The large joints are successively involved, shoulders, elbows, wrists, knees, ankles, hips, and occasionally smaller joints. When new joints are involved those first affected tend to clear up and when the disease is over no permanent changes remain. The affected joints are red, swollen, hot and exquisitely tender. The most characteristic feature of the disease is its tendency to injure the heart. It may attack the lining membrane leaflets and valves (endocardium), the heart muscle (myocardium) or the covering of the heart (pericardium). If the valves are principally affected we speak of endocarditis, if the pericardium, of pericarditis, if all the structures of the heart, of carditis. The advent of cardiac mischief, as the English phrase it, is detected by a rise in pulse and respiration rate, the development of a cardiac murmur, and later by car-

diac enlargement. Pericarditis is recognized by its special physical signs, to-and-fro rub, etc. Pleurisy, pneumonia, cerebral symptoms, and very high temperature are other complications of rheumatism. Sometimes joint symptoms are associated with purpura as described under *Purpura Rheumatica*.

Diagnosis and Prognosis.—Rheumatism is in itself rarely fatal, but as it is the most frequent cause of chronic valvular heart disease its ultimate consequences are very serious in many cases. The forms of valvular disease have been described in Part III. The close association of rheumatism with chorea (St. Vitus' dance) may be referred to in this connection. It is questionable whether there is any such condition as chronic rheumatism in the sense of a direct sequence to the acute disease. Cases so described are forms of mild arthritis or inflammation of the joints, due to a variety of causes. Some of them are mild forms of rheumatoid arthritis, others have nothing more behind them than flat-feet for example. Acute articular rheumatism may be confused with gout, with the acute forms or stages of rheumatoid arthritis, with infectious arthritis (particularly gonorrheal arthritis), etc.

Treatment.—Patients with rheumatism should sleep in flannel pajamas or nightdresses or between blankets. If cardiac complications ensue prolonged rest in bed may become necessary. The diet in the febrile period should be largely fluid with cereal additions, but later a simple but abundant diet should be given. This should include green vegetables, eggs, and a moderate amount of meat, as these patients are usually emaciated and anemic and require an abundance of nutritious foods rich in iron. Many physicians, however, would limit the meat more strictly than I have indicated.

The medicinal treatment of rheumatism is simple and satisfactory. It consists of suitable doses of salicylic acid or some of its derivatives. Alkalies are also used, either separately or in combination with salicylates, and recently vaccines have been employed by some

clinicians. The local treatment is more important from the nurse's stand-point. If no local medication is employed the joints may be wrapped in cotton-wool and in severe cases splinted. The feet should be protected by a cradle (as pressure is not only painful but in protracted cases may lead to "pointed toe" deformity). A cotton pad should also be placed beneath the tendo Achillis to prevent pressure on the heels which is likely to cause necrosis and ulceration. A great variety of local applications are employed such as lead water and laudanum, saturated solution of Epsom salt, diluted alcohol, oil of winter-green, medicated ointments, etc. When the swelling and stiffness of the joints are persistent massage and baking are often of use.

Mumps.—Mumps (epidemic parotitis) is an infectious disease which attacks children and young adults particularly.

The disease is more prevalent in the spring and autumn months than at other seasons. The incubation is long, from two to three weeks. The disease is contagious from the appearance of the first symptoms. The causal organism is not known: it is thought by some authors to be a diplococcus. As a rule the disease is very mild, beginning with a slight soreness of the throat, which is soon followed by enlargement of first one, and then the other parotid gland. The swelling is just below the ear and overlaps the angle of the jaw, which serves to distinguish it, as a rule, from simple lymphatic enlargements, which are below the border of the maxilla. The swelling is accompanied by slight fever and malaise which, however, last only a few days, while the swelling persists from a week to ten days; the lymphatic glands of the neck as well as the smaller salivary glands are also frequently swollen. More rarely distant glandular organs are attacked: breasts, ovaries, testicles, thyroids, and pancreas. None of these complications are common except orchitis (inflammation of the testicles), which occurs in epidemic form in boarding schools and military barracks.

To prevent the spread of mumps, it is necessary to isolate the patient for two weeks from the beginning of the symptoms or for one week after the disappearance of the swelling. As a rule no general treatment is necessary, local cold or hot-water compresses, lead water and laudanum, or a simple dressing of cotton being all that is required. During the first few days a liquid diet is usually acceptable on account of the difficulty in swallowing.

Measles (Morbilli, Rubeola).—Measles is an acute infectious disease characterized by catarrhal symptoms, fever, and later, a diffuse, patchy eruption. It is doubtless due to microorganisms, but none have as yet been discovered. It is found in all climates, in both sexes, and at all ages, but most frequently in children, as their elders have been protected by previous attacks. In isolated places (*e. g.*, Alaska) where the population has not been protected by attacks in childhood, very fatal epidemics have occurred in adults. One attack gives protection in the large majority of cases and physicians seldom see two attacks in the same person, although such a history is often given by patients. In such instances other infections have, as a rule, been mistaken for measles. The disease is infectious from the first catarrhal symptoms and is transmitted directly from patient to patient, rarely by second persons or infected objects. The infection seems to be principally contained in the discharge from the eyes, nose, and ears, seldom if at all, in the scales. It is extremely active, but does not stand drying or other unfavorable influences. Infection is therefore not air-borne except within short range, as from coughing and sneezing. The period of incubation before the appearance of the first symptoms is usually ten days, and before the appearance of the eruption, two weeks.

The disease begins with catarrhal symptoms and fever. The eyes are red, and bright light is unpleasant to the patient. There is coryza (running from the nose), hoarseness, sneezing, cough, and often looseness of the bowels. The inside of the mouth is red and swollen,

and very early in the disease white spots with a red border, no larger than a pin-head, are seen on the inside of the cheek. These are known as Koplik's spots and although difficult to distinguish are diagnostic of the disease. After about four days there is frequently a remission of a day or two in the fever and other symptoms on account of which the patient might be considered convalescent, but with the appearance of the eruption the fever again rises (see Fig. 50). The eruption usually appears first in the edges of the hair, or on the forehead, or below the ears, and then spreads to the face, limbs, and trunk. It is even seen on the palms and soles. It consists of little elevated red spots like minute pimples, grouped in irregular patches with white skin between, giving the patient a splotchy appearance very different from the uniform blush of scarlet fever. The general symptoms continue and the fever may be high, but in a few days it rapidly falls and convalescence begins. During the stage of convalescence desquamation of fine scales occurs (lasting for a week or a little more), and the patient barring complications, rapidly recovers appetite and strength. Numerous complications occur in measles. Bronchopneumonia is the most important and is responsible for the large mortality of this disease in infants. Bronchitis and tuberculosis are also common respiratory complications, the former being serious from its liability to terminate in pneumonia. Other sequels are defects of vision, deafness, and chronic enlargement of glands. The frequency of the latter complications can be much diminished by proper care of the mouth, nose, ears, and eyes.

There are many variations in the course of the disease. The fever and catarrhal symptoms may be very marked or almost absent while the eruption may resemble that of other infections or be simulated by them in turn. Drug and other accidental rashes may also cause confusion. Combinations with diphtheria, scarlet fever, and other infections are not rare. The prognosis is largely deter-

mined by these and the previously named complications. Uncomplicated measles is not a serious disease but the frequency of bronchopneumonia and of other grave complications makes it one of the most fatal of all infections. It is therefore not to be regarded lightly, especially in undernourished or frail infants.

Prophylaxis and Treatment.—Prevention is very difficult. Notification, quarantine, and other public measures are of little avail since the most infectious period has usually passed before the diagnosis is certain. In some places all regulation has been given up as useless, but it seems wiser to attempt to guard, as far as possible, children unprotected by a previous attack, and to disregard others. In hospitals and homes the patients should be isolated in well-ventilated rooms with the bed so placed that the light does not strike the eyes. The nasal and other discharges should be disinfected as well as utensils and clothing exposed to contamination. The attendants should wear gowns and caps and disinfect their hands and faces before leaving the room. Quarantine should be maintained for "ten days after the appearance of the rash and until all discharges from the nose, ears, and throat have disappeared and until all cough has ceased." The scales are not important, but their diffusion should be limited by the use of ointments and the usual antiseptic bath at the end of the illness.

Treatment is largely symptomatic. The patient should be kept in bed from the first and a fluid diet administered during the fever. As soon as the fever has disappeared soft diet may be given and later solids. As said before the eyes should be protected without limiting the ventilation. As in all infections water may be given freely. Tepid baths are used for high fever, restlessness, and insomnia. The mouth should be kept clean by the usual measures; spraying, or douching of the nose and throat will usually be approved by the physician. The bronchitis may require local stimulating applications to the chest such as camphorated oil, or mustard paste. If

pneumonia develops open-air treatment will be useful. If the rash does not "come out" promptly it has been a time-honored practice to bring it out with hot baths (mustard), etc.

German Measles (Rubella, Roseola).—German measles is a very mild infection resembling in some respects both scarlet fever and measles, but entirely distinct from either. The incubation may be as long as three weeks, although usually it is between two and three. Adults and older children are more frequently affected than young children. Like measles it has a period of invasion with catarrhal symptoms, but these are so mild that they are frequently overlooked. A general glandular enlargement is more or less distinctive of the disease. This enlargement persists during the rash but disappears in convalescence. The rash appears after several days, first on the face and later on the body, and finally on the limbs. At first there are red spots similar to those of measles but not elevated. On the chest and elsewhere they may coalesce and form a uniform rash, difficult to distinguish from that of scarlet fever. The eruption is peculiar, however, in that different stages are present at the same time in different parts of the body. The eruption disappears in a few days and the patient is convalescent. The temperature seldom rises above 100°. There are no complications, as a rule, and no mortality. The treatment is practically *nil*, although the patient should be kept in the house during the height of the disease. Partial quarantine is probably sufficient. The disease is infectious on close contact, but is seldom carried by a third party.

Scarlet Fever.—This disease is much less widespread than measles, being largely restricted to the temperate zone. It attacks only a small portion of those who are exposed to infection. It occurs in epidemic form and attacks principally young children. The infectious material is found in the discharges from the nose, ears and throat (or from suppurating glands), and to a less extent in the desquamating skin during early convalescence.

The infection, unlike that of measles, is very resistant and clings to clothing, infected rooms, etc., for a long period. It can probably be carried by a third person and such persons (carriers) may harbor the infecting organism in their throats. The causal microorganism is unknown but is probably a modified form of the streptococcus. The incubation is short, rarely over seven days, and usually only two or three days. The disease is infectious from the very beginning, but as the rash comes out within twenty-four hours, dissemination from failure to recognize the infection is less probable than in measles. The first symptoms are vomiting or convulsions, headache, and sore throat. The face is flushed, but the eruption appears first on the neck and chest and then spreads downward involving the limbs last. There is no real eruption on the face, but the pallor of the skin around the mouth in contrast to the red flush of the cheeks is striking. The eruption itself is made up of minute red points not at all raised and all blending together in a uniform red blush. On the extremities it is sometimes patchy and may be mistaken for measles. Typical cases with associated symptoms are easily recognized, but slight or atypical cases are difficult to distinguish from a multitude of other similar rashes. These rashes are the bug-bear of hospital interns and others who are charged with the duty of excluding infectious disease, and at the same time are not expected to exclude or mistake other conditions. In addition to measles, German measles, and even smallpox, all of which may closely simulate scarlet fever, there are deceptive rashes due to food infections, to serum injections, to drugs, and even to enemas. Drug rashes due to belladonna, quinin, sodium salicylate, and copaiba are well known.

Course.—The period of invasion lasts, as a rule, only twenty-four hours and is characterized by headache, vomiting, sore throat, fever, and rapid pulse. At the end of twenty-four hours the rash begins to appear and lasts about four days when it is succeeded by desquamation

which may last for six or seven weeks. The latter varies in character from a fine powder-like deposit to large sheets of skin which may form perfect casts of hands or feet. In mild cases in which the patients are seen in the later stages of the disease the diagnosis can often be made from the character of the desquamation. The fever rises rapidly with the onset, maintains its height during the acme of the disease, and falls rapidly, though not by crisis, with the disappearance of the rash. The normal temperature is reached about the seventh day. The pulse is at first out of proportion to the fever and this is regarded as a characteristic symptom. It may be noticeable in the earliest stages only. The throat is almost always red, swollen, and covered with mucus. In bad cases ulceration and membrane formation are seen. A mixed infection with diphtheria is not unusual. With the inflammation of the throat there is an associated enlargement of the glands of the neck. The tongue is at first heavily coated with white, but at the time of the appearance of the eruption the papillæ become red and swollen and project through the white, giving the tongue a strawberry-like appearance. A few days later after the coating has disappeared the tongue is red and the papillæ prominent, so that the organ looks like a raspberry. The term "strawberry tongue" is frequently applied to either or both of these appearances. Evidently the enlarged red papillæ are the characteristic features. With these more typical symptoms are associated the usual concomitant phenomena of fever: thirst, loss of appetite, gastro-intestinal derangements, scanty urine of dark color, mild delirium, occasionally convulsions at onset, etc.

The final stage of desquamation or convalescence is perhaps the one requiring the most care, for while the patient may feel almost well, it is during this time that the most serious complications occur. Endocarditis, otitis media, diphtheria, rhinitis, bronchopneumonia, arthritis, nephritis, and relapse are the most important. Of these nephritis is the most characteristic and the most

to be dreaded. The nasal and aural infections are important from the point of view of prophylaxis, as the discharges are prone to convey the disease and to prolong the period of infectivity. The onset of nephritis should be immediately revealed by routine examination of the urine. The usual symptoms are: headache, convulsions, nausea, vomiting, high pulse tension (high blood-pressure),



FIG. 63.—Desquamation in scarlet fever. (Welch and Schamberg.)

edema, scanty, smoky urine, etc. Nephritis often does not occur until the third week of convalescence or later. Diphtheria is common after scarlet fever, especially in institutions, but if it is recognized promptly and treated with antitoxin the mortality is not so high as might be expected. Middle-ear disease is a prolific cause of deafness, but here again early treatment produces good results.

As in other infections there are several types described:

mild, or trivial cases, simple cases covered by the above general description, toxic or malignant cases in which the symptoms are intense, and death supervenes in a few hours or days, and septic cases in which the throat symptoms, swelling, exudation, ulceration, and glandular enlargement are in the ascendant. The last type requires active local treatment. Scarlet fever, uncomplicated, is more fatal than measles, but is not so important a cause of death on account of its restricted distribution. The complications are greatly feared rather for their ultimate results than on account of the immediate danger.

Prophylaxis and Treatment.—Prophylactic measures are of more importance in scarlet fever than in measles, both on account of the severity of the infection and because there is a much better chance of preventing the spread of the disease (possibility of early diagnosis and general unsusceptibility). The health officer does not have to contend, as in the case of measles, with the fatalistic idea that infection is sooner or later inevitable, and that efforts at prevention are useless. On the other hand, there is no specific protective measure comparable to vaccination in smallpox. In view of these facts the patient should be rigidly quarantined with an attendant, and the quarantine maintained for five or six weeks from the onset (in New York thirty days). The general details have already been described. Contacts after receiving a disinfectant bath and donning clean clothing should not associate with children for a week at least, *i. e.*, until the period of incubation has passed (in Philadelphia two weeks). The patient should be frequently anointed with ointment, with or without antiseptics, in order to limit the dissemination of scales, and the nose and throat should receive attention. Slight desquamation need not be a bar to raising the quarantine, but aural or nasal discharge is of more importance. Some authorities (Ker) advise that discharged patients should avoid intimate contact (kissing, etc.), with susceptible persons for a long period of time.

PLATE V



Smallpox (Typical Distribution).

Notice the eruption on face is crusting while the remainder is at its height. (Knowles).



To a certain extent the treatment is also of a preventive nature so far as the patient is concerned. Flannel night clothing and blankets instead of sheets should be used, and rest in bed continued for two weeks during convalescence, as a precaution against nephritis and joint complications. For the same reason the febrile diet of milk should be adhered to until late in convalescence. To this fruit, breads, cereals, vegetables, and eggs may be added. Meat, fish, and fowl should be excluded until the danger of nephritis is well over. The toilet of the mouth, nose, and throat is most important for the avoidance of aural and respiratory complications. In case of nephritis the usual measures (see Acute Nephritis) to secure elimination will be in order. Serums and vaccines have been used in scarlet fever but are not much in vogue. Drug treatment is purely symptomatic.

Smallpox or Variola.—In former times smallpox was a scourge almost as common as measles is now, and like the latter disease attacked children principally. It was very fatal and even those who recovered were frequently disfigured by excessive scarring. At the present time owing to the efficiency of vaccination, it is a relatively rare affection; during seventeen years of practice, the writer has encountered only two or three cases. Many cases moreover are modified by vaccination and are very mild (varioid). Small epidemics occur from time to time, principally in unprotected persons or in adults who have outgrown their childhood immunity (from primary vaccination). In countries where revaccination is systematically practised, as in Germany, the disease is almost non-existent. In England, on the other hand, where the scruples of individuals are allowed to defeat the purpose of vaccination laws, serious epidemics have occurred, one of the worst in recent years having been in Jenner's own county. The causative organism of smallpox has not yet been discovered, but recent reports indicate that the solution of the problem may not be long delayed. In the pustular stage ordinary pus organisms occur as secondary invaders.

After an incubation of about twelve days the disease sets in suddenly with high fever, loss of appetite, sleeplessness, delirium, severe headache and backache, chills, and perhaps nausea and vomiting. Sometimes a diffuse rash occurs which may mislead the physician and suggest scarlet fever or other infections. With the appearance of the eruption on the third day the "initial" fever disappears. The stage of remission lasts about four days. The eruption appears as little reddish, "shot-like" elevations or papules about the wrists and in the edge of the hair. The face, forearms, and wrists show the most profuse eruption while the chest and abdomen may be almost or entirely free. After a day or a day and a half, the papules become vesicles (blisters) filled with clear fluid. This gradually becomes milky and finally, about the sixth day of the disease, the vesicles are converted into "umbilicated" pustules. Finally the pustules rupture and form crusts which separate after a period of weeks to leave the characteristic pitted scars. During the pustular stage there is a secondary irregular fever which varies in degree and duration in accordance with the profuseness of the eruption. In mild cases or in varioloid there may be only a few pustules on the face or wrists, while in the confluent or severe types the face may be a mass of pustules blended together by inflamed and edematous skin. In such cases the secondary fever may be high and its associated symptoms severe. The severest form is hemorrhagic or black smallpox. Complications are not common, the most frequent being conjunctivitis; otitis, and affections of the respiratory tract. Mild cases are difficult to diagnose and are responsible for the wide diffusion of the disease. For this reason chicken-pox cases, especially in adults, are always viewed with suspicion when variola is epidemic. Chicken-pox is often seen on the body while smallpox, as we have seen, usually spares the trunk.

Vaccination renders the prophylaxis of smallpox comparatively simple. Affected persons are always removed

to special hospitals where the strictest quarantine is exercised (isolation for at least two weeks). The infected quarters, clothing, etc., are disinfected and those who have been exposed are vaccinated. When the disease is prevalent all who have not been recently vaccinated should undergo the operation again. Otherwise vaccination in infancy and again on entering school is probably sufficient. Even after an attack of the disease itself immunity tends to become less with time, although a certain resistance may always persist.

Vaccinia.—Vaccinia is a disease of cattle (a similar affection is found in horses) which manifests itself as pustules on the udders. The local and constitutional symptoms are of a very mild character, but Jenner found that milkmaids and others who had acquired the infection in their work were immune to smallpox. Prior to this discovery it was customary to inoculate people with actual smallpox virus to gain immunity from the ravages of the pest. Jenner was thus able to test the efficacy of vaccination by inoculation and to confirm his observations. From that time inoculation, which had sometimes been fatal and was always liable to spread the disease by contagion, was replaced by this new and practically harmless method. In Jenner's time, and even down to the last quarter of the nineteenth century, it was customary to take the scab from a healthy child and preserve it for future vaccinations. While this was on the whole a satisfactory plan it occasionally led to unfortunate consequences on account of the simultaneous inoculation of other diseases, particularly of syphilis. However, objections based on this score are no longer valid, as humanized lymph is not used at the present time. At present lymph is obtained by inoculating the udders of healthy calves. The pulp so obtained is mixed with glycerin and kept until free from contaminating organisms. The calves are killed and examined for tuberculosis or other disease and the vaccine is tested for freedom from tetanus. Serious infections due to the lymph itself are now of the rarest

occurrence, although a vaccination wound, like any scratch if carelessly treated, may serve as an avenue of entrance for some chance infection such as erysipelas. The nature of vaccinia was long unknown; at the present time there is little reason to doubt that it is a mild form of variola which has been robbed of its virulence and contagiousness by passage through an extremely resistant animal. This produces a permanent change in the virus without depriving it of its specific protective power against smallpox.

In persons who have been vaccinated and are still immune revaccination does not "take," but on the second day a small area of redness appears which indicates their immunity. It is similar to the von Pirquet reaction, which is employed in the diagnosis of tuberculosis. In susceptible persons, on the other hand, nothing is seen until the third or fourth day, when a papule appears. On the fifth day vesiculation occurs and this is in turn succeeded by pustulation, crusting, and scarring. The total duration is three or four weeks. Mild constitutional symptoms may be present for a day or two with local induration and swelling. More severe reactions are usually due to mixed infection with pus organisms. These seldom prove serious and are treated on general antiseptic principles. Enlargement of the neighboring lymphatic glands is the rule. The site of vaccination is not important; it is usually practised on the arm near the insertion of the deltoid or on the outer side of the leg near the head of the fibula, the choice being determined by the freedom of these regions from movement.

Chicken-pox.—Chicken-pox or varicella is one of the least serious of all the infections and one that rarely requires treatment. As already stated it is of most importance on account of its resemblance to varioloid. The incubation is approximately two weeks and the eruption may be the first and only symptom, although slight fever for two or three days is the rule. The eruption, unlike that of smallpox, is chiefly confined to the trunk, but a few vesicles appear on the face also. The eruption

comes out in crops, first as papules and then as vesicles. The vesicles dry to crusts, but occasional ones form pustules, and presumably give rise to the characteristic scars with which almost all persons are marked. The irregularity of the eruption and its situation usually suffice to distinguish it from varioloid, but at times the most experienced are puzzled. On account of the contagious character of the disease children should be isolated for at least twelve days and until the crusts have separated. Other children of the family should be kept from school.

CHAPTER VII.

INFECTIOUS AND PARASITIC DISEASES— CLASS IV.

IN this group the infectious agent enters by the mouth (hookworm disease, in which it enters through the skin, is an exception) and as a rule multiples in the gastro-intestinal tract.

(a) The infection is disseminated principally by the intestinal discharges. Bacterial infections (one exception).

(b) Dissemination occurs through the agency of intermediate hosts. Animal parasites.

A. BACTERIAL INFECTIONS.

Typhoid or Enteric Fever.

Course of the Disease.

Complications and Sequelæ of Typhoid.

Treatment of Typhoid Fever.

Diet in Typhoid Fever.

Hydrotherapy.

Malta Fever.

Cholera.

Dysentery, Bacillary and Amebic.

B. INTESTINAL AND VISCERAL PARASITES.

Threadworms.

Treatment.

Round or Lumbricoid Worms.

Hookworms and Hookworm Disease.

The Trichina and Trichinosis.

Tapeworms.

Echinococcus Disease.

A. BACTERIAL INFECTIONS.

Typhoid or Enteric Fever.—The name typhoid ("typhus like") recalls the confusion that formerly existed between this disease (typhus abdominalis) and the now rare jail or ship fever (typhus exanthematicus) which we usually designate simply as typhus. Our German patients, on the other hand, when they speak of an attack of "typhus" usually mean enteric fever. Typhoid fever is caused by the *Bacillus typhosus* and is characterized pathologically; by ulceration in the lower part of the small

intestine, by enlargement of the spleen, and by degenerative changes in the heart, liver, and other organs; clinically: by a prolonged febrile course (commonly three to six weeks), an eruption of rose spots, bronchitis, diarrhea, delirium, stupor, and exhaustion.

The characteristic ulcers* involve the thin areas of tonsil-like tissue known as Peyer's patches, which are situated in the last few feet of the ileum just before it enters the large bowel. At first they are merely swollen, but about the third week of the disease they begin to



FIG. 64.—Ileum from a case of typhoid fever, showing ulceration of solitary follicles (*b*) and of a small Peyer's patch (*a*). (Adami and McCrae.)

ulcerate and present a ragged appearance. The ulceration may involve small bloodvessels, causing serious or fatal hemorrhage, or the bowel may be perforated with the production of peritonitis. The spleen is large and soft and can usually be readily felt during life.

The typhoid bacilli are found not only in the intestinal ulcers but in many other organs and tissues and even in the rose spots. They are readily cultivated from the blood early in the disease so that blood cultures form one of the earliest and most reliable means of diagnosis.

CHAPTER VII.

INFECTIOUS AND PARASITIC DISEASES— CLASS IV.

In this group the infectious agent enters by the mouth (hookworm disease, in which it enters through the skin, is an exception) and as a rule multiples in the gastrointestinal tract.

(a) The infection is disseminated principally by the intestinal discharges. Bacterial infections (one exception).

(b) Dissemination occurs through the agency of intermediate hosts. Animal parasites.

A. BACTERIAL INFECTIONS.

Typhoid or Enteric Fever.

Course of the Disease.

Complications and Sequelæ of

Typhoid.

Treatment of Typhoid Fever.

Diet in Typhoid Fever.

Hydrotherapy.

Malta Fever.

Cholera.

Dysentery, Bacillary and Amebic.

B. INTESTINAL AND VISCERAL PARASITES.

Threadworms.

Treatment.

Round or Lumbricoid Worms.

Hookworms and Hookworm Disease.

The Trichina and Trichinosis.

Tapeworms.

Echinococcus Disease.

A. BACTERIAL INFECTIONS.

Typhoid or Enteric Fever.—The name typhoid ("typhus like") recalls the confusion that formerly existed between this disease (typhus abdominalis) and the now rare jail or ship fever (typhus exanthematicus) which we usually designate simply as typhus. Our German patients, on the other hand, when they speak of an attack of "typhus" usually mean enteric fever. Typhoid caused by the *Bacillus typhosus* and is pathologically: by ulceration in the lower

At the end of a week or ten days certain substances are found in the blood which have the power, when brought into contact with active living typhoid bacilli in pure culture, of checking their movements and causing them to clump. This is the basis of the valuable and diagnostic Widal reaction. Material for this test is obtained by puncturing the finger and collecting a little blood in a narrow tube which is drawn out at the ends to permit

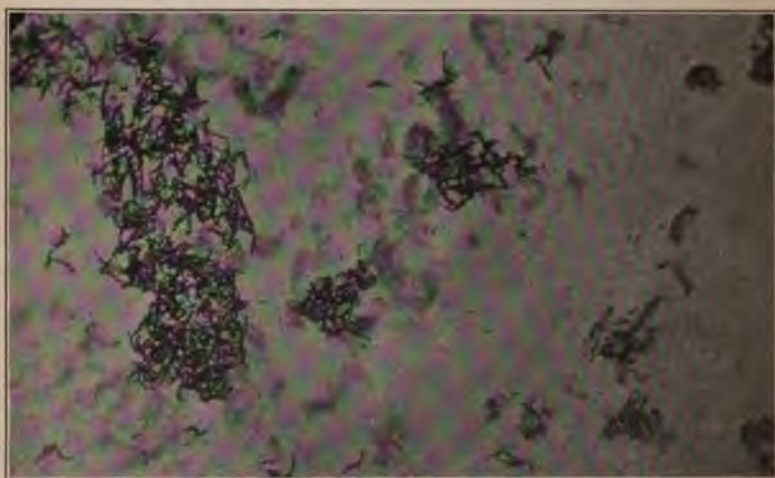


FIG. 65.—Positive Widal test showing clumping of bacilli (magnified).
(Simon.)

sealing by heat. Another method is to catch a few drops of blood on a piece of glazed paper or on a glass slide. If this method is employed the blood should be thoroughly dried before it is sent to the laboratory.

Many obscure epidemics, particularly in institutions, have been traced to carriers. When these persons are employed in the kitchen the danger is of course increased. Lettuce and other "truck" vegetables are frequently fertilized with "night soil" and this may lead to obscure

sporadic or epidemic outbreaks. Oysters are open to contamination on account of the custom of "fattening" them in fresh water (often contaminated with sewage) after their removal from the salt water. Flies have also been convicted of carrying typhoid bacilli from infected discharges to the food (from "latrine" to "mess-tent"). I have considered these less frequent causes in order to call attention to their importance in many cases, but I do not mean to undervalue the most prolific source of typhoid infection, namely, drinking-water. Wells and springs in the country are very often badly placed and open to contamination from surface drainage or from underground communication with sources of pollution. City supplies are open to more gross defilement from sewers and streams, etc. Tardy efforts are being made to minimize these conditions and the large cities of the Eastern States have recently spent scores of millions in either filtering bad water or in bringing pure water from a great distance. Frequently chlorinated lime is employed to purify water supplies, but usually as an accessory measure. In many cities the disease is decreasing, but it still maintains its hold in the country. Its frequent occurrence and prolonged course make it the most important of acute infections both for the nurse and the physician.

Course of the Disease.—There are a great many variations in the course of typhoid cases, some of which will be described below. The following sketch will serve to illustrate the course of an ordinary case unmodified by treatment (see Fig. 52). The incubation is on the average ten days. The symptoms at first are indefinite: "generally out of sorts," loss of appetite, headache, diarrhea, abdominal pain, cough, slight chills, gradually increasing fever, etc. Nosebleed is common, but not so invariable as commonly thought. Constipation is almost as frequent at this stage as diarrhea. At the end of a week the temperature has climbed to 102°, 103°, or 104° and the patient has usually succumbed and gone to bed. The next week

or two are characterized by many of the same symptoms in an aggravated degree. The fever is high and continuous with a slight morning remission. Hydrotherapy has little or only a temporary effect on the temperature. The pulse is relatively slow but soft and dicrotic. (See pages 86 and 87.) Rose spots appear on the abdomen, chest, and shoulders. Headache is replaced by stupor and delirium. The tongue if not persistently treated becomes dry and brown and the teeth are covered with dry brown deposits known as "sordes." Diarrhea may be severe with stools of a "pea soup" consistency and musty odor. In the third week, or in prolonged cases perhaps in the fourth or fifth week, the morning temperature begins to show very marked remissions and reacts readily to measures adopted to lower it. This period corresponds to that of ulceration in the bowel, and perforation or hemorrhage is to be dreaded. Stupor and delirium continue and emaciation and weakness are progressive. Bronchitis which is often marked in the early stages is replaced by congestion in the dependent portions of the lungs. In the fourth or final week of fever the temperature gradually descends to normal, the patient's mind becomes active, the appetite returns, and a rather tedious convalescence begins. This is liable to be marred by the recrudescence of fever from constipation, overfeeding, or other slight causes, by relapse, in which the whole course of the disease is repeated, usually in an abbreviated and milder form, but occasionally with greater severity, or by one of the many unfortunate sequels.

Occasional cases occur with symptoms resembling typhoid in which a Widal reaction fails to appear. These are frequently due to organisms allied to the typhoid bacillus, but differing from it in some respects. Paratyphoid is the most common of these fevers. Colon bacillus infection may also produce a similar train of symptoms but it is more likely to invade the genito-urinary tract, inducing pyelitis, etc.

The mode of onset and course of the disease may show many variations. Some cases are so mild in their onset or the patients are so insensible to suffering that they continue on their feet for the first week or two of the disease. These cases are known as "walking typhoid." The prognosis is usually more serious than that of the ordinary disease. Other cases pursue an exceptionally mild and abbreviated course. Atypical modes of onset are those with acute nephritis and uremia, with croupous pneumonia, with violent delirium, or with severe chills.

Complications and Sequelæ of Typhoid.—The complications and sequelæ of typhoid are legion. Some of them consist merely in an exaggeration of ordinary symptoms of the disease such as bronchitis and diarrhea. It will save time, however, to take them up systematically.

Mild delirium and mental hebetude, as mentioned above, are almost invariable symptoms of the disease; occasional cases are marked from the onset by wild maniacal delirium. More characteristic is a low muttering delirium associated with picking at the bedclothes or at imaginary objects, twitching of the tendons (*subsultus*), dry, brown tongue, *sordes* on the teeth, general muscular relaxation (slipping down in the bed), and incontinence of urine and feces. When these symptoms of extreme prostration ("typhoid state") develop in other diseases they are sometimes described as "typhoid," irrespective of the presence or absence of enteric fever (for example "typhoid pneumonia"). This is often a source of confusion in history taking. Thanks to good nursing and the stimulation of the nervous, cardiovascular, and respiratory systems by cold baths, these symptoms are seldom seen in typhoid at the present day. Insanity, due either to intoxication or exhaustion, is not an unusual sequel of the disease. As previously stated (page 36) the prognosis is usually favorable for ultimate recovery. Neuritis with paralysis occurs occasionally as a sequel. It is common, however, for patients

to suffer from hyperesthesia of the extremities, "tender toes."

More or less profound anemia is a natural sequel of so severe a disease. This is of the secondary type, *i. e.*, the coloring matter of the blood suffers more than the cell count. During the fever the leukocytes are reduced in number (leukopenia); if inflammatory complications occur this characteristic leukopenia is replaced by a leukocytosis.

Valvular heart disease is not common, but myocardial weakness is the rule in severe cases. In convalescence patients sometimes have a rapid, but more often an extremely slow, soft pulse. One of the common complications of the disease is phlebitis; this almost always affects the left femoral vein and causes at first moderate pain (avoid rubbing or massage in suspicious cases), and later marked swelling (edema) of the extremity. It is identical in symptoms and treatment with that seen after childbirth (milk leg).

Bronchitis is one of the ordinary symptoms of typhoid fever and is only to be regarded as a complication when it is excessive in degree, or when it extends to the finer bronchioles or alveoli (bronchopneumonia). In severe cases there is almost always passive congestion at the bases of the lungs revealed by dulness and fine rales ("moist" or bubbling sounds on auscultation). The patient's position should be changed from time to time to obviate this condition so far as possible. Croupous pneumonia may complicate the disease at the onset, as already mentioned, or later during its course.

Loss of appetite is more or less constant in all severe cases during the febrile stage, but in convalescence the appetite is inordinately great. Gaseous distention of the abdomen or tympanites is often a serious complication. Sometimes it appears to be due to the diet (milk), although it may be due in part to a toxic paralysis of the bowel wall. Diarrhea is a regular symptom of the disease, but when excessive is a very serious complication.

Constipation is common in convalescence; sometimes the accumulation of feces is so great as to require removal by instrumental means (*e. g.*, by handle of a spoon). The most serious and fatal complications of typhoid are hemorrhage and perforation, both of which occur as a rule in the later weeks of the disease. The onset of hemorrhage is suggested by a sudden fall in the temperature, rapid, feeble pulse, increasing pallor, etc., and is confirmed by the appearance of blood in the stools. This may appear as large clots or the stools may present a tarry appearance. In the presence of hemorrhage the patient should be kept absolutely quiet and if there is any mental or physical agitation a hypodermic of morphin (gr. $\frac{1}{4}$) should be administered. Many physicians will not allow even a bed-pan to be used for fear that the added exertion may renew the hemorrhage. The foot of the bed should be raised and an ice-bag applied to the abdomen. In an emergency the nurse should treat the patient along these lines but should omit administering medicine by the mouth or bowel unless specifically ordered. Astringents by the mouth, although of doubtful efficacy, are sometimes used by the physician. Gelatin may be given freely by the mouth to favor clotting; its employment by subcutaneous injection has proved too hazardous (tetanus) and painful to encourage its further use. Calcium lactate by the mouth and blood serum administered subcutaneously are now extensively used to promote clotting. Perforation of the intestine occurs in the lower part of the small intestines, rarely in the large, and results from deep ulceration, excessive distention, etc. The cure of this otherwise fatal complication by operation depends upon early diagnosis. The accident is suggested by a sudden fall in the temperature, an increased rapidity of the pulse, sudden pain, or increased tenderness and rigidity of the abdomen, etc. Any symptoms in the least degree suggestive should be immediately reported to the physician. Sudden severe pain in the lower abdomen is very characteristic, but is often masked by the apathetic

state of the patient. The patient should be kept absolutely quiet and the pain relieved if necessary by an ice-bag.

Inflammation of the gall-bladder is a common complication or sequel of typhoid fever. The bile is a very favorable culture medium for typhoid bacilli and they have been found in the gall-bladder years after infection. The complication is important rather as a cause of gall-bladder disease than on account of any acute symptoms during the typhoid attack. In typhoid "carriers" the bacilli frequently come from an infected gall-bladder.

Albuminuria is very common in the course of this disease and severe nephritis occasionally occurs. I have seen patients die with uremic symptoms at the height of a typhoid attack. Typhoid bacilli are almost constantly found in the urine and if they persist into convalescence, the patient becomes a source of danger to others ("carriers").

Joint affections are not common as complications or sequels of typhoid but occasionally occur. The spine is frequently affected, causing chronic pain and rigidity ("typhoid spine"). Periostitis of the tibia and other bones is not very unusual. Of the skin complications the most troublesome is furunculosis. When a single case exists in a ward the infection is very liable to spread to others. Careless bathing and sponging are frequently responsible for the transference of the infection from patient to patient.

Treatment.—*Prophylactic Treatment.*—The stools and urine should be disinfected by the addition of equal parts of 5 per cent. carbolic, milk of lime, 3 per cent. chlorinated lime, 10 per cent. formalin solution, etc. After thoroughly mixing the vessels should be allowed to stand for some time before being emptied. In some large hospitals double jacketed receivers are provided for sterilization by live steam. Bedding, clothing, etc., should be soaked in carbolic or placed immediately in a boiler for sterilization by heat. Gauze and cotton used for cleansing the

mouth, etc., should be burned. The patient's dishes should be kept separate from those of the household and should be sterilized at the end of the case or after each feeding according to circumstances. The room or ward should be well screened and infected objects should be immediately covered in order to prevent access of flies. Nurses and attendants should scrub their hands thoroughly before eating. Carelessness in this respect is probably the cause of the undue frequency of typhoid among nurses and orderlies. Antityphoid vaccination is now being used as an additional prophylactic, but the security against infection thus afforded does not excuse carelessness in preventive treatment. The prophylaxis of typhoid in the hospital is simplified when the patient can be treated in special wards.

The patient suffering from typhoid should be kept at absolute rest. This necessitates the use of the bed-pan and urinal. A soft but firm mattress is sufficient in the majority of cases but with severe emaciation or a tendency to bed-sores an air- or water-bed is preferable or even essential. Sometimes bony prominences may be protected by rubber or cotton rings. On account of the danger of bed-sores and of "hypostatic" congestion of the lungs the patient should not be permitted to rest constantly on the back, but should be turned frequently from side to side. The back and buttocks should be frequently cleansed, sponged with alcohol, and thoroughly powdered. (Compound stearate of zinc or talcum powder.) These precautions are particularly essential if the patient is incontinent. In many cases it is necessary to support the bedclothing on a cradle to protect the toes (if tender) from pressure. In men and children it is usually best to cut the hair closely, but in women frequent and thorough combing and brushing may obviate the necessity of this measure. An ice-cap applied to the head is grateful in cases with severe headache; it should be loosely filled so as to conform to the shape of the head and must be water-tight. Some physicians apply to the

abdomen an ice-bag, a coil with running cold water, or ice compresses. If the latter are used the patient will need to be well protected with water-proof linen or silk. Special attention should be given to the care of the mouth, teeth, and tongue which should be rinsed after every feeding and cleaned with pledgets of cotton, moistened in a mild antiseptic solution with or without glycerin.¹ A dry, brown, fissured tongue and teeth heavily coated with sordes are usually due to defective nursing as much as to the condition of the patient.

Diet.—The traditional diet in typhoid consists of milk with the occasional addition of broth, beef-juice, and egg-water. This regimen (*e. g.*, a glass of milk every two hours for ten feedings) seldom yields more than fifteen hundred calories and frequently much less, about eight hundred, if broth is given alternately with milk. The advantages of this diet are the sense of security which it gives against hemorrhage and perforation, its simplicity, and its ease of digestion. Its chief disadvantages are the marked loss of nutrition, the tendency to meteorism (distention), and the impossibility of satisfying the patient's appetite as convalescence approaches. Disturbances due to milk diet are sometimes attributable to an impure supply (high bacterial "count") and not to the milk in itself. Few physicians now adhere to this rigid dietary throughout. Raw or soft-boiled eggs, junket, corn-starch, and other semisolid foods are commonly added as convalescence approaches. Other physicians, while employing a diet which is largely liquid (milk), increase its caloric value enormously by the addition of milk-sugar, cream, eggs, cereals, etc. (up to five thousand or six thousand calories). The aim is to furnish sufficient food to maintain completely the nutrition of the body, in spite of the additional drain upon it resulting from infection. A diet sheet prepared for the purpose of

¹ Equal parts of a saturated solution of boric acid and glycerin, to which a little lemon juice may be added. Liquid petrolatum is useful for moistening the lips.

facilitating the prescription of such a diet is shown in the chapter on Metabolism. A third method of dieting admits the free use of semisolid or even solid food to suit the appetite of the patient; this treatment originated in Russia and the good results obtained have shown the fallacy of some of the older theories. The nurse should of course follow the method of dieting favored by the physician in attendance. Whatever the diet, water, lemonade, and other fluids should be offered to the patient at frequent intervals to promote a free excretion of toxins.

Hydrotherapy.—Hydrotherapy occupies a very prominent place in the treatment of typhoid. It has been found that the application of cold water not only reduces the temperature temporarily but has a most stimulating effect on the nervous system, lessening stupor and delirium and indirectly improving the appetite, etc. The circulation in the skin is also improved, breathing is deepened, and the kidney secretion is increased. Cold water may be applied in many ways, but is most frequently employed in the form of full cold baths, wet packs, or sponges. The full or Brand bath is by far the most effectual method of treatment. In hospitals it is usual to give a bath every three hours, when the temperature reaches a certain height (*e. g.*, 103°). Most physicians do not give more than three or four baths a day and none at night. The general condition of the patient is a better indication for the use of hydrotherapy than the temperature alone, but in ward work some routine procedure is necessary as a basis and may be modified to suit individual cases. In mild cases or in the presence of complications which forbid the use of the full bath, sponges and wet packs may be employed for a similar end. If there is danger of hemorrhage or perforation tub baths are contra-indicated, largely on account of the necessary disturbance to the patient.

Drugs.—The drug treatment of typhoid is almost entirely symptomatic. Many physicians place faith in an initial dose of calomel, but during the course of the disease purga-

tives should be avoided (this opinion is by no means universally held). Many antiseptic and antipyretic drugs have been employed from time to time, but no general agreement has been reached as to the value of any one in particular. Salol is perhaps most frequently used. Whisky was formerly given as a routine in the course of typhoid, because it was thought to serve both as a food and a stimulant. As we have seen, it serves the former purpose only when given in small quantities, while its stimulating properties are entirely denied in many quarters. It is now used for special indications only.

Malta Fever.—This disease is so rare in this country that it requires only brief mention. It occurs principally in the countries bordering on the Mediterranean and particularly at Malta. It is due to a bacillus which is found in the milk of infected goats and is acquired by using milk, or milk products derived from this animal. The prophylaxis is therefore evident. It is characterized by fever which resembles that of mild typhoid fever, but differs from it in that it relapses or recurs, time after time, often for many months (hence the name undulant or wave-like fever). The mortality is low but the treatment is very unsatisfactory. Change of climate is the most effectual measure.

Cholera.—Cholera Asiatica is due to the "comma bacillus" (spirillum) of Koch and is disseminated by drinking-water in much the same manner as typhoid fever. Its natural habitat is the tropics whence it spreads to the temperate zone in epidemic form, when faulty hygiene or a vulnerable water supply afford it an opportunity. It is now many years since it has invaded the United States, although many cases have been brought to New York from infected ports. In 1892, for example, during the Hamburg epidemic, many cases were discovered on incoming vessels but by rigid quarantine measures, of which the writer was, by the way, an innocent victim, the disease was excluded. In Arabia, India, etc., the disease is endemic and is spread by the annual pilgrimages

to Mecca and to other shrines. It frequently extends northward into Russia in the direction of the trade routes and usually finds hygienic conditions favorable to its spread in epidemic form. The disease is also prevalent in our own tropical possessions, at Manila and elsewhere.

The incubation is brief, from two to five days, and is followed by diarrhea. The stools at first resemble those of ordinary enteritis, but soon become very frequent, thin, and watery ("rice-water stools"). Severe vomiting and cramps in the muscles of the abdomen and legs are a prominent feature. The extremities are cold and blue and greatly shrunken from the excessive loss of fluid. Collapse rapidly ensues. Suppression of urine is usual. Death may follow in a few hours or days, or reaction may occur and the patient gradually regain health and strength. Exhaustion or complications may claim victims in the late stages. In the Hamburg epidemic the mortality was approximately 50 per cent.

Cholera nostras (morbus) and *cholera infantum*, which attack adults and infants respectively, are severe forms of diarrhea with almost identical symptoms. They occur in temperate climates in the summer months. They may be very fatal but do not become epidemic.

In England affected ships are fumigated, those ill of the disease are isolated, and those who have been exposed are allowed to proceed to their own homes but are kept under observation until the end of the period of incubation. In this country a much more rigid quarantine is necessary, because cases cannot be adequately treated and supervised after they have once entered the country, on account of the lack of a centralized department of health. During the course of an epidemic, protection is obtained by boiling the water and by eating cooked food only. Prophylactic inoculation has also been used during epidemics.

The treatment of cholera consists in irrigation of the bowels with tannic acid or other astringent solutions, large intravenous saline injections, and symptomatic measures.

Dysentery, Bacillary and Amebic.—There are two principal types of dysentery: one due to the *Bacillus dysenteriae* and related organisms, the other to an animal or protozoan parasite, the *Ameba dysenteriae*. The former is the common cause of acute dysentery, both in the temperate and in the tropical zones; it is also a factor in many of the summer diarrheas of infancy and may cause chronic dysentery. The ameba is responsible for a small portion of the acute and for much of the chronic dysentery of the tropics and it frequently gives rise to liver abscesses. Americans and Europeans whose work carries them to the tropics are frequently invalidated home on account of the latter form of the disease.

The typical symptoms of dysentery are the passage of frequent small stools, consisting largely of mucus and blood with painful straining (rectal tenesmus). These symptoms distinguish it from ordinary enteritis, in which the stools are thin and fecal in character, and mucus and blood, if present at all, are intimately mixed. In enteritis, pain is either absent or colicky in its nature and is felt about the navel. In cholera defecation is usually painless. Acute dysentery may be mild and of brief duration, but usually the movements are frequent and fever and constitutional symptoms marked. Even acute forms tend to become subacute and to persist indefinitely. Emaciation and anemia are progressive and the patient, if untreated, may eventually perish from exhaustion or intercurrent complications. Perforation of the bowel, peritonitis, hemorrhage, liver abscess, and arthritis may be mentioned as complications likely to occur. After recovery there is frequently a marked liability to recurrence from quite trivial causes, such as unsuitable diet or change of temperature. Persistent cases are often relieved by removal to a cold climate.

The prophylaxis is practically the same as that of typhoid and cholera. Improved sanitation has made dysentery of minor importance in modern armies, at least in the temperate zone, although as late as the Civil War it was a most serious cause of invalidism and death.

In both forms of dysentery, especially if chronic, medicated fluids containing tannic acid, nitrate of silver, quinin, etc., are used to irrigate the lower bowel. In the bacillary type bismuth and similar drugs with opium are frequently employed, while in the amebic form ipecac, or emetin which is derived from it, are administered in large doses with remarkably good results. Abscess of the liver is treated by incision and drainage usually with good success.

B. INTESTINAL AND VISCERAL PARASITES.

The more highly organized parasites which prey upon man do not often give rise to the reactions in the human organism which we are accustomed to see in bacterial infections, *e. g.*, fever and associated symptoms. It is a matter of convenience, however, to consider these so-called infestations in this connection, because of a certain similarity in modes of propagation and prophylaxis. Parasites of all kinds and particularly intestinal parasites are far more common in the tropics than in the temperate zone; we can refer only to the more common varieties observed in this latitude.

Threadworms.—Of the general class of roundworms the most familiar is the threadworm (*Oxyuris vermicularis*) which is so commonly found in the rectum of children. These worms are very small, from one-fifth to two-fifths of an inch in length, and have a habit of wandering out of the rectum particularly at night and laying their eggs. In girls they may enter the vagina. The eggs therefore are not ordinarily found in the stools. Their migrations may give rise to irritation, itching, and scratching. In children with susceptible nervous system they occasion muscular twitching, disturbed sleep, and similar manifestations. Reinfection may occur by the introduction of the eggs into the mouth. Other children acquire the infection by direct contact, or from green vegetables, or from other food that may have been contaminated by fecal matter (fertilizer).

Treatment.—Cleanliness is important to avoid infection and reinfection. Migrations of the worms (*e. g.*, to the vagina) are sometimes prevented by placing a ring of mercury ointment about the anus. The parasites are removed by flushing the lower bowel with simple salt or with some medicated solution. An infusion of quassia made by pouring a quart of water on one or two ounces of the chips is the most popular remedy.



FIG. 66.—1. *Oxyuris vermicularis*: a, male; b, female; natural size.
2. Magnified. (Simon.)

The "Roundworm."—The common roundworm (*Ascaris lumbricoides*) is a much larger parasite, measuring from six to sixteen inches in length. It is more at home in the upper part of the small intestine, but occasionally wanders into the appendix, gall ducts, stomach, and even larynx. The symptoms are ordinarily extremely vague: picking at the nose, grinding of the teeth, and even convulsions are attributed to the presence of this parasite. The diagnosis is made by finding the eggs in the stools. Under the microscope the eggs, with their rough envelope, are quite distinctive. Treatment is usually by *santonin*. It is given in one-half- to two-grain doses, combined with *calomel*. The patient should fast for some time before

treatment is begun and subsequently a purgative should be administered.

Hookworms and Hookworm Disease.—This disease, until a few years ago considered to be rare, has come to be recognized as one of the most common and serious maladies of the Southern States. It is almost universal

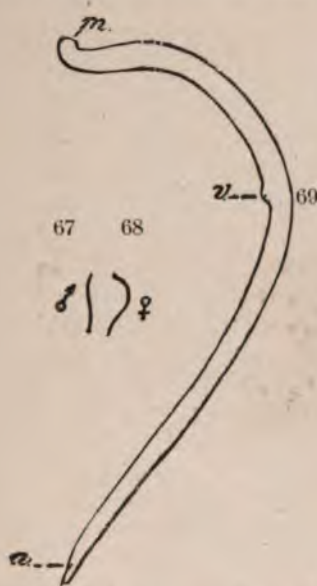


FIG. 67.—New World male hookworm. Natural size. (Stiles.)

FIG. 68.—New World female hookworm. Natural size. (Stiles.)

FIG. 69.—The same, enlarged to show the position of the anus (a) and the vulva (v). (Stiles.)

in Porto Rico and has been a subject for extensive investigation by the government authorities since our recent conquest of the island. The New World variety (*Necator Americanus*) is about twice as large as the ordinary threadworm. It is possessed of minute teeth, by which it attaches itself firmly to the inside of the intestine. Its eggs are discharged in the stools, but infection does not

appear to enter, as a rule, by the mouth. The eggs develop in the soil and the larvæ gain access to the body by burrowing through the skin, causing inflammatory symptoms known as "ground-itch" in those who go barefoot. Once within the body, the parasites make their way by devious paths to the intestines.

The disease may produce no symptoms, but as a rule it causes intense anemia accompanied by a deathly pallor and extreme lassitude, so that the parasite has been humorously called the germ of laziness. The infection may prove fatal.

The prophylactic treatment consists in proper sanitary arrangements (well-arranged out-houses, drains, etc.), to prevent the contamination of the soil by fecal discharges and in the wearing of shoes and stockings. Where the country is extensively infected, as in Porto Rico, the stools of suspected persons should be examined to confirm the diagnosis and treatment administered in accordance with the findings. This is both for the advantage of the patient and for the good of the community.

The curative treatment consists in the administration of thymol, chenopodium, or other vermifuges in suitable doses, preceded by fasting and saline purgatives and followed by renewed purgation.

The *Trichina* and *Trichinosis*.—The *Trichina spiralis* is a minute intestinal worm which is ordinarily found in hogs but is occasionally seen in man. The female worm deposits the embryos in the intestinal wall so that they immediately reach the lymph or bloodvessels and by these paths reach the muscles all over the body, where they develop into larvæ and become encapsulated. In this state they remain dormant indefinitely, but if the uncooked flesh containing the larvæ is eaten the larvæ develop in the intestine into the full-grown worm, and the cycle begins anew in the new host. In human beings infection usually results from eating smoked, imperfectly cooked, or raw ham (after the German fashion).

The ingestion of the infectious food at first induces

few or no symptoms (sometimes mild gastro-enteritis) but at the end of one or two weeks the migration of the embryos into the muscles causes severe pains, high fever, and a train of symptoms not unlike those of typhoid.



FIG. 70.—*Trichinella spiralis* in muscle, greatly magnified. (Simon.)

Quite commonly there is edema of the eyelids. These symptoms—fever, severe muscle pains and edema—in a person who admits indulgence in raw or insufficiently cooked pork, are very suggestive of trichinosis. If in

addition, examination of the blood shows a leukocytosis with an unusual proportion of certain white blood cells known as eosinophiles, the diagnosis is practically certain. In sections of muscle, if such can be obtained, the trichina may be seen under the microscope. There is no treatment other than measures directed to relieve the sufferings of the patient. The preventive treatment is evident; no pork except that which is known to be thoroughly cooked should be eaten.

Tapeworms.—Of the many varieties of tapeworms only one is common in the eastern United States. This is the beef tapeworm (*Tenia mediocanellata*). This worm, like the others of this group, consists of a chain of flattened segments and a head. The head is a little larger than that of a large pin and is attached to the mucous membrane of the intestine by four suckers. The segments near the head, in which situation growth takes place, are small and elongated, but toward the free extremity they increase in size and become more nearly square. The fully developed segments are as large as the thumb-nail and if held up to the light show a finely branched or tree-like uterus with an opening at one side. From time to time short sections, consisting of ripe segments, are detached and are seen in the stools. The worm may reach a great length, as much as twenty-five feet.

In spite of its great size this parasite causes extremely indefinite symptoms. There may be vague digestive and nervous disturbances. It is usually diagnosed by the finding of the segments in the movements, or by detecting the eggs in the stools by microscopic examination. In the ox the parasite is found in the muscles in the larval stage (*cysticercus*). Infection may be prevented by eating only well-cooked meat, and avoiding beef and sausage which have merely been smoked or dried.

The pork tapeworm (*Tenia solium*) is very similar to the beef tapeworm. The head is armed with hooklets as well as suckers, the uterus is not so finely divided, and the length of the worm is somewhat less. It is found

in countries where pork is eaten in a more or less uncooked condition. Self-infection may occur, but the pig is the usual intermediate host.

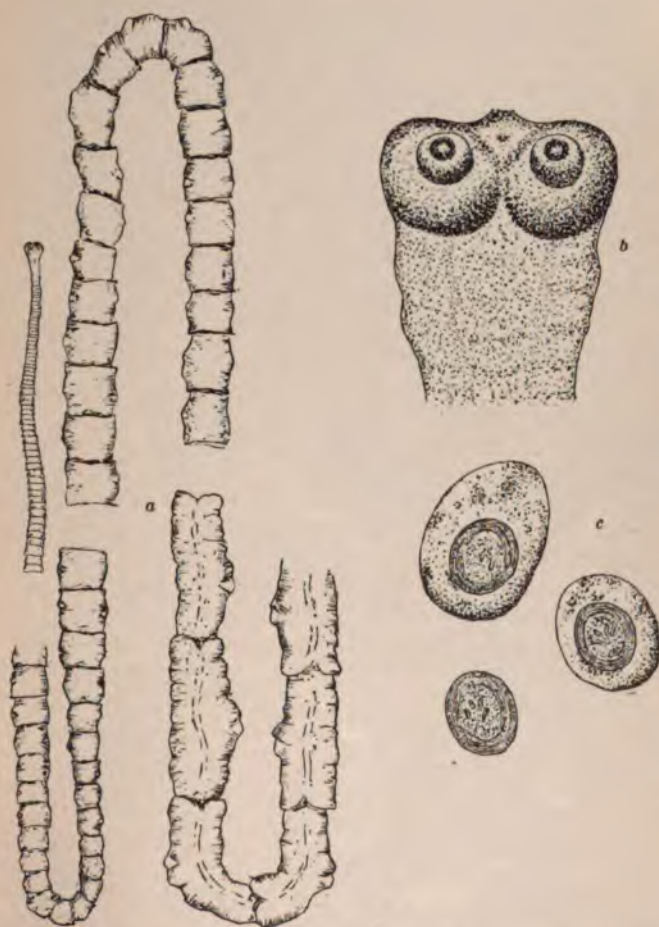


FIG. 71.—*Tenia saginata*: *a*, natural size; *b*, head, much enlarged; *c*, ova, much enlarged. (Simon.)

The fish tapeworm, or *Bothriocephalus latus*, is common in countries in which fish forms an important part of the diet, and especially in Scandinavia. Imported cases are not unusual in this country. This worm is even longer than the beef tapeworm, the segments are broad and short, and the uterus resembles a rosette. This is a much more serious infestation than those previously described, as it frequently leads to a very high degree of anemia resembling the pernicious type.

Echinococcus Disease.—*Tenia echinococcus* is a small tapeworm found in dogs, which occurs in the larval form (hydatids) in man, particularly in the viscera. The larvæ developing in the tissues or organs produce enormous cysts filled with smaller "daughter" cysts. The cysts contain characteristic hooklets. The liver and spleen are the organs usually involved. The disease is rare here but common in South America.

Tapeworms are treated by fasting, purgation, and vermifuges. The vermifuges in common use are the oleoresin of aspidium (male fern) and the tannate of pelletierin (from pomegranate). Pumpkin seeds are sometimes used. *Echinococcus* cysts when large enough to be diagnosed with certainty should be incised and drained.

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